Land Use Policy Group

The UK statutory conservation, countryside and environment agencies

Maximising the Provision of public goods from future agri-environment schemes

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The Land Use Policy Group
The Land Use Policy Group (LUPG) of the UK statutory nature conservation, countryside and environment agencies comprises the Countryside Council for Wales, Natural England, Environment Agency, Environment and Heritage Service of Northern Ireland, Joint Nature Conservation Committee and Scottish Natural Heritage.

The LUPG aims to advise on policy matters of common concern related to agriculture, woodlands and other rural land uses. It seeks to improve understanding of the pros and cons of policy mechanisms related to land use, particularly farming and forestry; to develop a common view of desirable reforms to existing policies; and to promote these views.www.lupg.org.uk

Countryside Council for Wales
The Countryside Council for Wales champions the environment and landscapes of Wales and its coastal waters as sources of natural and cultural riches, as a foundation for economic and social activity, and as a place for leisure and learning opportunities. It aims to make the environment a valued part of everyone's life in Wales.
www.ccw.gov.uk

Natural England
Natural England is the statutory body working to conserve and enhance England's natural environment, for its intrinsic value, the wellbeing and enjoyment of people and the economic prosperity that it brings. Its role is to ensure that England's unique natural environment, including its land, flora and fauna, freshwater and marine environments, geology and soils, are protected and improved. Natural England also has the responsibility to help people enjoy, understand and access the natural environment.
www.naturalengland.org.uk

Scottish Natural Heritage
Scottish Natural Heritage (SNH) is a government body established to secure conservation and enhancement of Scotland’s unique and valued natural heritage – the wildlife, habitats and landscapes that have evolved in Scotland through long partnership between people and nature. SNH advises on policies and promotes projects that aim to improve the natural heritage and support its sustainable use. It’s aim is to help people to enjoy Scotland’s natural heritage responsibly, understand it more fully and use it wisely so it can be sustained for future generations.
www.snh.org.uk

The Environment Agency
The Environment Agency (EA) is the leading public organisation for protecting and improving the environment in England and Wales. The EA achieves this by regulating industry, waste and water quality; managing flood risk and water resources, and improving wildlife habitats in addition to many other activities. The EA also monitors the environment, and makes the information that it collects widely available.
www.environment-agency.gov.uk

Environment and Heritage Service
Environment and Heritage Service (EHS) is an Agency within the Department of the Environment in Northern Ireland. EHS takes the lead in advising on, and in implementing, the Government's environmental policy and strategy in Northern Ireland. The Agency carries out a range of activities, which promote the Government's key themes of sustainable development, biodiversity and climate change. The aims of EHS are to protect and conserve Northern Ireland's natural heritage and built environment, to control pollution and to promote the wider appreciation of the environment and of best environmental practices.
www.ehsni.gov.uk

Joint Nature Conservation Committee
The Joint Nature Conservation Committee (JNCC) is the statutory adviser to Government on UK and international nature conservation. Its work contributes to maintaining and enriching biological diversity, conserving geological features and sustaining natural systems.
JNCC delivers the UK and international responsibilities of the four country nature conservation agencies - Council for Nature Conservation and the Countryside, the Countryside Council for Wales, Natural England and Scottish Natural Heritage.
www.jncc.gov.uk

Disclaimer
This report was produced by the authors on behalf of the Land Use Policy Group (LUPG). The views expressed within the report are those of the contractors and do not necessarily reflect the views of the agencies within LUPG.

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Executive Summary

Project objective
Agricultural policy has recently undergone major changes at EU level following the introduction of decoupled payments, whilst at UK level the introduction of entry level schemes has fundamentally altered the approach to agri-environment schemes. At the same time, there is considerable uncertainty over the future conditions surrounding agricultural production, especially whether commodity price levels will continue their recent rise or revert back to the longer term experience of decline. Given such a context, the objective for this project is to fundamentally re-examine the way in which the objectives for the provision of public goods from agri-environment schemes may be delivered more effectively.

Theoretical analysis
Public goods are defined by the characteristics of their consumption. Pure public goods are 'non-excludable' (once supplied, everyone can benefit) and 'non-rival' (consumption by one person does not reduce supply for others). These characteristics mean that they are under-supplied by markets, and hence, that there is a role for government in their provision. However, there are difficulties with this, primarily because there is no interaction of demand and supply, which in a properly functioning competitive market produces the most favourable resource allocations, sets optimal prices, and encourages innovation to improve both efficiency and quality. Thus government has to estimate both the level of demand (i.e. how much consumers value agri-environment goods) and the price to offer farmers for supply. Both are significant challenges. Public goods from agri-environment schemes include:

Biodiversity and landscape conservation
- Species and habitat management
- Amenity and cultural values of wildlife and habitats
- Aesthetic, historic and cultural values of landscapes

Resource protection and management
- Soil and water quality
- Carbon storage
- Flood risk management

Social and health benefits
- Public access and amenity

Demand for public goods
Countryside public goods are demanded by the British public as evidenced by rural tourism, responses to surveys, and media interest. Techniques used to define priorities and trade-offs for agri-environment public goods may be categorised as:

- Monetary valuation.
- Objectives expressed by representative organisations.
- Ecological analysis.
- Public opinions (represented via surveys, polls, and deliberative exercises – where groups of citizens make decisions after examining the relevant information).

However, there is relatively little published in terms of specific demands in particular circumstances. There has been considerable research undertaken on the monetary valuation of agri-environment goods, some of which identifies specific figures for willingness to pay, but the conceptualisation of the goods is generally relatively simplistic and the methodology remains controversial. Even so, monetary valuation exercises can, if properly conducted, give some idea of relative priorities although a major objective of the research has tended to be on the development of new methodologies which means that results are often not directly

comparable. While accepting that there are some fundamental limits of the reliability and comprehensiveness of demand estimates, further work in this area could be helpful.

The Introduction of entry level schemes

An examination of the adoption of entry level schemes in the UK has been undertaken by using the English Entry Level Scheme (ELS) as a case study. The ELS is open to all farmers who wish to take up the payment offered in return for maintaining or creating public goods and has drawn in many farmers who have not previously participated in agri-environment schemes. This represents a novel approach in that all farmers who can meet the criteria are eligible for payment, irrespective of how the land would have been managed in the absence of the scheme. It establishes the principle that farmers deserve payment for the maintenance of the countryside to a certain standard. This principle and the wide range of management options from which farmers can choose may place limits on the extent to which the scheme achieves major environmental enhancement in practice. The agricultural characteristics of farm holdings are the primary determinant of uptake in the sample examined, although there is some evidence that other factors may also have an influence. The precise impacts on the environment may never be defined accurately given the uncertainty as to the counterfactual situation. A key question is whether the ELS in England, and similar schemes in Wales and Scotland, are buying the countryside goods that are most desired in an effective way. Given the flexibility in the scheme it would be remarkable if this was the case, and this implies that future development of entry level schemes should take account of national and regional environmental priorities as compared to the management options taken up by participating farmers.

Case studies

The case studies concentrate on innovative approaches to public good provision related in turn to specific issues of concern within the UK. Not all possible innovations could be included and each study deals both with the issue of 'what to do' and 'how to pay for it'.

- Collective Hedgerow Plantings Denmark has a long history of collective planting of hedgerows, initially in response to soil erosion problems, but more recently for the purpose of general environmental enhancement. The scheme has effectively co-ordinated farmer behaviour and operates at relatively low administrative costs. Current initiatives are exploring the potential for more comprehensive nature management plans.
- Land Purchase The Netherlands has an ambitious programme for the establishment of a National Ecological Network that is secured by a combination of land purchase, land entered into agri-environment schemes, and land managed for nature by private organisations. The NEN includes areas of high environmental quality as well as the land necessary to connect these into a linked network. While land purchase is relatively expensive, it offers greater long term security for the delivery of environmental benefits. However, the relatively high cost of land purchase has meant that political pressures have more recently favoured agri-environment schemes where a larger area can be covered and more funds distributed to farmers. Nevertheless, land purchase remains a significant element of the approach.
- Conservation Reserve Program (CRP) This was introduced in the USA in the 1980s as a further stage in the policy of land retirement and supply side control. It is a large scale programme that has developed over time with regard to its environmental objectives. Whilst initially operated in response to competitive tenders from landowners, the approach was revised once applicants started to learn the maximum levels of rent that would be paid. Bids for entry are now ranked against an Environmental Benefits Index (EBI). The EBI gives credit for a variety of forms of conservation land management and

includes points for farmers who are prepared to enter their land into the scheme at lower levels of payment. There has been extensive economic analysis of the scheme and the benefits generated and this points to a substantial net economic gain.

- BushTender Two experimental schemes have been introduced in Australia to allocate contracts for the restoration of native bushland on a competitive basis. Initial analysis seemed to indicate very substantial gains from the tendering process in comparison to a fixed payment scheme but subsequent analysis suggests that the gains are actually much more modest, and that they tend to fall in successive rounds of tenders. Environmental Benefits Indexes were used to help target the environmental benefits. The implementation of the schemes demonstrated the importance of leadership and the involvement of 'community officers' was seen as critical to success.
- Environmental co-operatives These co-operatives have been developed in the Netherlands and have been successful in encouraging farmers to participate in agri-environment schemes and to introduce more innovative approaches to environmentally sensitive farming. There is also a suggestion that they can be more effective than government at policing schemes. However, there are weaknesses, such as the need to build trust, difficulty determining payment levels and designing an effective legal and administrative structure, as well as securing benefits for the long term. The potential of this approach should be explored further.

There seems to be some convergence of agri-environment measures in OECD countries. In particular, there has been an increasing focus on schemes designed to provide a wider range of environmental benefits. Experience suggests that competitive tendering does not provide the long term increase in cost-effectiveness that had been hoped for – but scoring against an EBI can help to target schemes on priority benefits and can include an element of price competition (especially where participants have the option of offering a lower price). The main themes from these case studies include: i) co-ordinating decisions amongst farmers; ii) securing conservation benefits by purchase of property rights; or iii) using more competitive allocation mechanisms.

Level of payment

In principle, payments should be made against the results achieved (environmental outcomes) as this would provide the clearest possible signal to farmers. In practice, however, outcomes can be difficult to measure. As a result, payments have usually been made in return for specified changes in land management practice. Levels of payment for agri-environment public goods have been set by government on the basis of the estimated income foregone and costs incurred as a result of the commitments required under the scheme. Under the current EU Rural Development Regulation (1698/05), agri-environment payments continue to be linked to income foregone (this principle is also enshrined in the WTO Green Box). The reliance on income foregone reflects the situation when most agri-environment schemes were introduced, but the position is somewhat different once agricultural activities start to operate at a loss. In such cases there is no 'income foregone'. However, there is still an 'opportunity cost' in terms of the resources needed to conduct the agricultural activity required (since these resources might otherwise be transferred to some other use). This opportunity cost is, in principle, the income foregone.

However, such an approach assumes that there is a viable business to carry out the agri-environmental work. Where a business is not viable, the provision of the current type of agri-environment payments (whether based on income foregone, or the opportunity cost of the changes associated with entry into an agri-environment scheme) will not improve the

position. The situation would be improved, though, if agri-environment payments took more account of the level of fixed costs required to provide the kind of farming activity necessary for the desired environmental outcome. More work is needed on the variable and fixed costs applicable to different farming situations, in particular how these costs are related to the appropriate level of farming activity necessary to deliver the sorts of environmental public goods required. Such an approach could form the basis for assessing the most appropriate payment levels required in order to maintain whatever activity is necessary in order to achieve the environmental objectives. At present, however, the maintenance of agricultural production may often be determined by the financial situation of the farm household as a whole. Therefore, there may be closer links than is generally recognised between economic support for households in rural areas and the protection of rural environments, where the primary threat relates to land being taken out of some form of management. Thus support for wider rural economic development may also be helpful provided this can offer new or enhanced sources of income in support of farm households.

Development of plausible scenarios for the future

The objective of the scenarios is to set out the potential conditions under which agri-environment schemes will operate, and the challenges that may be faced in sustaining the provision of public goods in the countryside. There are two fundamental types of driver: the financial returns available to alternative land uses and the agri-environmental and environmental policy context. This suggests four possible scenarios:

- **'Managed'** - High Economic Returns and Active Agri-Environmental Policy. This is associated with intensively farmed land but the active agri-environment policy operates to protect the environment from damage.
- **'Exploited'** - High Economic Returns and Inactive Agri-Environmental Policy. This is associated with intensive land use, but there is a threat that the environment will be degraded in the absence of environmental incentives
- **'Wildness'** - Low Economic Returns and Active Agri-Environmental Policy. There is less pressure on the land due to the lower financial returns. Together with an active agri-environmental policy, this results in a well managed environment.
- **'Neglected'** - Low Economic Returns and Inactive Agri-Environmental Policy. Low returns would mean that land could be used very extensively or even abandoned. In the absence of a strong agri-environmental policy, land may simply be neglected resulting in a variety environmental gains and losses depending on the specific context.

Discussion of criteria for use in evaluating agri-environmental innovations within the UK

A number of criteria are identified as a basis for assessing potential innovations viz:

- Environmental impacts
- Precision (efficiency less transaction costs)
- Transaction costs
- Dynamic incentives (incentives/flexibility to respond to changing conditions)
- Security against future changes
- Leverage (resources from non-governmental sources)
- Property rights and wider acceptability

Potential agri-environmental innovations and their contribution

This section assesses potential innovations using the above criteria in the face of the alternative scenarios.

- Creating a co-operative environment: The context within which farmers make decisions about scheme take up can be an important factor. The Dutch environmental co-operatives and the Australian experience with Landcare indicate that institutions can be developed to engage stakeholders and to promote farmer participation in differing circumstances.
- Collective contracts: In some contexts it will be important to promote a more formal arrangement amongst agri-environment participants. Collective contracts can enable groups of farmers to determine the allocations of costs and activities amongst themselves. They have the potential to work under a number of scenarios.
- Tendering for cost-effective purchasing: As has been indicated the benefits from tendering are less clear cut than may have been anticipated. More work is necessary before this approach would seem to offer an immediate way forward for UK agri-environment schemes.
- Land purchase with long term and specialist management: In the face of uncertainty as to the future conditions for agricultural production, there may well be gains to be made from securing those conservation benefits achieved to date and by guaranteeing sensitive management of critical sites. This can be achieved by means of land purchase, albeit the costs of such an approach are front loaded.
- Regulation: It will not always be assumed that farmers have the rights to make changes in land use and management and there will be junctures when regulation is the appropriate mechanism. Regulation can be a cheaper but relatively blunt instrument.
- Alternative funding sources including markets and local funding: There may be alternative ways by which funds can be raised for agri-environment schemes. More work is needed to identify the available options and their potential impacts on environmental quality.
- Conservation covenants and burdens: Conservation easements are widely used by Land Trusts in the United States as a means for private organisations to promote environmental protection. This would seem to have potential in the UK in rather different circumstances. It is unclear whether or not the current provision for conservation burdens offers this possibility in Scotland.
- The production of agri-environment plans: Agri-environment schemes offer environmental benefits that can support a range of government objectives and that are valued by a variety of stakeholders. This implies that these interests should be represented in some sort of agri-environment planning process.
- Rebalancing entry level schemes: The entry level schemes have established a framework with relatively low administration costs. Under continuing funding scenarios these might be rebalanced by altering the options available and the points awarded for them. Given the differences in take up between regions, it may well be appropriate to offer different option menus in different regions.

Two approaches for further development of agri-environment schemes

1. *Developing and rebalancing the entry level schemes*

Entry level schemes have the potential to make a more substantial contribution to environmental quality. There are two particular policy issues that they could address. Decoupling agricultural support payments leaves set-aside without any substantial supply control rationale and it is most likely that it will be phased out. However, it has been shown to promote environmental benefits. At the same time a number of river catchments are at risk of failing to meet Water Framework Directive standards due to diffuse pollution. Extended entry level top up schemes, perhaps implemented against an Environmental Quality Index, could provide a mechanism whereby these environmental

policy objectives could be addressed. Enhanced funding for such schemes will be required from government.

2. *Resilient countrysides*

A major threat to agricultural environments is that many of the gains that have been achieved over the past twenty years may be lost if commodity prices continue their recent rises and funding for current agri-environment schemes does not increase in line. This risk applies both to landscape and biodiversity features on the ground, but also to the social capital (in the form of the knowledge, skills and institutions) that has been built up through the implementation of existing agri-environment schemes. In the context of the uncertain future facing agriculture at the present time, there are gains to be made from more permanent arrangements, such as by land purchase and by conservation covenants. However, such an approach would have to be carefully targeted and requires a systematic planning process and extensive public engagement. Locally based approaches, perhaps based on the Joint Character Area system developed in England and supported through LEADER projects could offer a mechanism for drawing stakeholders and landholders together. Local priorities could then be identified and implemented through land purchase and covenants co-ordinated by local conservation bodies (Conservation Amenity and Recreation Trusts) as well as the more conventional agri-environment arrangements.

Conclusions

Agri-environment schemes are facing a period of uncertainty, both in the context of recent agricultural policy and agri-environmental policy changes and with regard to the possibility of much higher commodity prices in the future. It is also likely that set-aside will be discontinued and its environmental benefits lost. This presents a potential challenge for agri-environment policy and may threaten the conservation gains that have been delivered by agri-environment schemes over the past twenty years. It suggests that, whilst there is still support and funding from the CAP, it may be prudent to attempt to 'lock-in' some of the gains made from agri-environment schemes.

The main conclusions of this study are as follows:

- Payment-by-results schemes may represent a potentially valuable alternative to current payment systems, but more work is needed on scheme design and operation.
- More information is required on the variable and fixed costs of the agri-environmental options facing those farmers whose businesses are providing low incomes, and where businesses are not viable it is likely that agri-environment schemes will have to take account of both fixed and variable costs if land is to be kept in productive use.
- There are a number of innovations and alternative approaches in other countries that offer pointers to the ways in which policy might be developed in the UK.
- The adoption of entry level schemes within the UK has established a framework that could be further developed to address a number of government policy objectives.
- Potential also exists for the development of further local rural conservation initiatives through a process that draws interested parties together to identify priorities and then uses land purchase, covenants, and existing agri-environment scheme mechanisms to achieve local objectives.

More research is needed on several aspects of the potential scheme innovations reviewed in this report. Many countries are involved with the development of agri-environment schemes, often with quite similar objectives. It is important to learn from this experience so as to inform the future development of agri-environment schemes within the UK.

Crynodeb Gweithredol

Amcan y prosiect

Mae polisi amaeth Ewrop wedi newid yn sylweddol yn ddiweddar yn sgil datgysylltu taliadau, ac ar yr un pryd ar lefel y DG, mae cyflwyno cynlluniau lefel mynediad wedi newid yr ymagwedd at gynlluniau amaeth-amgylchedd yn sylfaenol. Ar yr un pryd, mae cryn ansicrwydd ynghylch amodau cynhyrchu amaethyddol yn y dyfodol, yn enwedig ynghylch a fydd prisiau'n parhau i godi fel yn ddiweddar neu'n dychwelyd i'r gostyngiad hirdymor. Gan ystyried cyd-destun o'r fath, amcan y prosiect hwn yw ailystyried yn sylfaenol y ffordd y gellir darparu buddion cyhoeddus o gynlluniau amaeth-amgylchedd yn fwy effeithiol.

Dadansoddiad damcaniaethol

Diffinnir buddion cyhoeddus yn ôl nodweddion y defnydd ohonynt. Mae buddion cyhoeddus pur yn 'aneithriadwy' (unwaith y'u cyflwynir, gall pawb fanteisio) ac yn 'anghystadleuol' (nid yw defnydd un person yn lleihau'r cyflenwad i eraill). Golyga'r nodweddion hyn bod cyflenwad marchnadoedd yn annigonol ac o'r herwydd, fod rhaid i'r llywodraeth eu darparu. Fodd bynnag, mae hyn yn creu anawsterau, yn bennaf am nad oes rhyngweithio rhwng y galw a'r cyflenwad, sydd, mewn marchnad gystadleuol sy'n gweithio'n gywir, yn arwain at ddyrannu adnoddau yn y modd mwyaf manteisiol, yn pennu'r prisiau gorau, ac yn annog arloesi er mwyn gwella effeithlonrwydd ac ansawdd. Felly, mae'n rhaid i'r llywodraeth amcangyfrif maint y galw (h.y. faint o werth mae defnyddwyr yn ei roi ar fuddion amaeth-amgylchedd) a'r pris i'w gynnig i ffermwyr am eu cyflenwi. Mae'r heriau hyn yn rhai sylweddol. Ymhlith buddion cyhoeddus cynlluniau amaeth-amgylchedd mae:

Bioamrywiaeth a chadwraeth tirwedd
- Rheoli rhywogaethau a chynefinoedd
- Gwerth amwynder a diwylliannol bywyd gwyllt a chynefinoedd
- Gwerth esthetig, hanesyddol a diwylliannol tirweddau

Gwarchod a rheoli adnoddau
- Ansawdd pridd a dŵr
- Storio carbon
- Rheoli'r risg o lifogydd

Buddion cymdeithasol ac iechyd
- Mynediad ac amwynder cyhoeddus

Y galw am fuddion cyhoeddus

Mae'r cyhoedd ym Mhrydain yn mynnu buddion cyhoeddus yng nghefn gwlad fel y tystia twristiaeth wledig, ymatebion i arolygon, a diddordeb y cyfryngau. Gellir rhannu'r technegau a ddefnyddir i ddiffinio blaenoriaethau a chyfaddawdau ar gyfer buddion cyhoeddus amaeth-amgylchedd i'r categorïau a ganlyn:

- Prisiad ariannol
- Amcanion a fynegir gan sefydliadau cynrychiadol
- Dadansoddiad ecolegol
- Barn gyhoeddus (a gynrychiolir gan arolygon, polau, ac ymarferion trafod – lle bydd grwpiau o ddinasyddion yn gwneud penderfyniadau ar ôl ystyried yr wybodaeth berthnasol.

Fodd bynnag, nid oes llawer wedi'i gyhoeddi o ran gofynion penodol dan amgylchiadau penodol. Mae llawer o ymchwil wedi ei wneud i brisio ariannol buddion amaeth-amgylchedd, a pheth ohono'n nodi ffigurau penodol ar gyfer parodrwydd i dalu, ond fel arfer mae cysyniadau'r nwyddau braidd yn or-syml ac mae'r fethodoleg yn parhau i fod yn

ddadleuol. Serch hynny, o'u cynnal yn gywir, gall ymarferion prisio ariannol roi rhyw syniad o flaenoriaethau cymharol er bod datblygu methodolegau newydd wedi bod yn un o brif amcanion yr ymchwil, sy'n golygu na ellir cymharu canlyniadau'n uniongyrchol yn aml. Er ein bod yn derbyn bod rhai terfynau sylfaenol ynglŷn â pha mor ddibynadwy a chynhwysfawr yw'r amcangyfrifon o'r galw, gallai rhagor o waith yn y maes hwn fod yn ddefnyddiol.

Cyflwyno cynlluniau lefel mynediad

Archwiliwyd mabwysiadu cynlluniau lefel mynediad yn y DG gan ddefnyddio Cynllun Lefel Mynediad (ELS) Lloegr fel astudiaeth achos. Mae'r ELS yn agored i bob ffermwr sy'n dymuno derbyn y taliad a gynigir am gynnal neu greu buddion cyhoeddus ac mae wedi denu llawer o ffermwyr nad ydynt wedi cymryd rhan mewn cynlluniau amaeth-amgylchedd o'r blaen. Mae hyn yn ymagwedd newydd yn yr ystyr bod pob ffermwr a all fodloni'r meini prawf yn gymwys ar gyfer y taliad, waeth sut byddai'r tir wedi'i reoli heb y cynllun. Mae'n sefydlu'r egwyddor bod ffermwyr yn haeddu tâl am gynnal cefn gwlad i safon arbennig. Gall yr egwyddor hon, a'r amrywiaeth eang o ddewisiadau rheoli y gall ffermwyr ddewis ohonynt, gyfyngu ar welliant amgylcheddol ymarferol y cynllun. Nodweddion amaethyddol daliadau fferm sy'n bennaf gyfrifol am benderfynu a ddylid cyfranogi, yn ôl y sampl a archwiliwyd, er bod peth tystiolaeth y gall ffactorau eraill hefyd fod â dylanwad. Efallai na chaiff yr union effeithiau ar yr amgylchedd byth mo'u diffinio'n gywir oherwydd yr ansicrwydd ynghylch y sefyllfa wrthffeithiol. Cwestiwn allweddol yw a yw'r ELS yn Lloegr a chynlluniau tebyg yng Nghymru a'r Alban, yn prynu'r buddion cefn gwlad a ddymunir fwyaf mewn modd effeithiol. Gan ystyried hyblygrwydd y cynllun, byddai'n hynod pe bai hyn yn wir, ac mae hyn yn awgrymu y dylai datblygiad cynlluniau lefel mynediad yn y dyfodol ystyried blaenoriaethau amgylcheddol cenedlaethol a rhanbarthol yn hytrach na'r dewisiadau rheoli a dderbynnir gan ffermwyr sy'n rhan o'r cynllun.

Astudiaethau Achos

Mae'r astudiaethau achos yn canolbwyntio ar ymagweddau arloesol at ddarparu buddion cyhoeddus sydd yn eu tro yn ymwneud â materion penodol sy'n peri pryder yn y DG. Byddai'n amhosibl cynnwys pob arloesiad posibl ac mae pob astudiaeth yn ystyried 'beth i'w wneud' yn ogystal â 'sut i dalu amdano'.

- Cyd-blannu Gwrychoedd. Mae gan Ddenmarc brofiad helaeth o gyd-blannu gwrychoedd, yn wreiddiol fel ymateb i broblemau erydu pridd, ond yn ddiweddarach er mwyn gwella'r amgylchedd yn gyffredinol. Mae'r cynllun wedi cydlynu ymddygiad ffermwyr yn effeithiol ac mae ei gostau gweinyddu'n gymharol isel. Mae mentrau presennol yn ymchwilio i'r posibilrwydd o gael cynlluniau rheoli natur mwy cynhwysfawr.
- Prynu Tir Mae gan yr Iseldiroedd raglen uchelgeisiol ar gyfer sefydlu Rhwydwaith Ecolegol Cenedlaethol wedi ei sicrhau gan gyfuniad o brynu tir, cynnwys tir mewn cynlluniau amaeth-amgylchedd, a rheoli tir ar gyfer natur gan sefydliadau preifat. Mae'r Rhwydwaith hwn yn cynnwys ardaloedd o ansawdd amgylcheddol uchel yn ogystal â'r tir sydd ei angen er mwyn cysylltu'r rhain mewn rhwydwaith cysylltiedig. Er bod prynu tir yn gymharol ddrud, mae'n cynnig mwy o ddiogelwch yn y tymor hir ar gyfer cyflawni manteision amgylcheddol. Fodd bynnag, mae'r gost gymharol uchel o brynu tir wedi golygu bod pwysau gwleidyddol yn ddiweddar wedi ffafrio cynlluniau amaeth-amgylchedd lle gellir cynnwys ardal fwy a dosbarthu mwy o arian i ffermwyr. Serch hynny, mae prynu tir yn dal i fod yn elfen bwysig o'r ymagwedd.
- Rhaglen Gwarchodfeydd Cadwraeth (CRP) Cyflwynwyd y rhaglen hon yn yr Unol Daleithiau yn y 1980au fel cam pellach yn y polisi o dynnu tir allan o gynhyrchu a rheoli'r ochr gyflenwi. Mae hon yn rhaglen fawr sydd wedi datblygu gydag amser o

ran ei hamcanion amgylcheddol. Yn wreiddiol, fe'i gweithredwyd mewn ymateb i dendrau cystadleuol gan dirfeddianwyr, ond cafwyd newidiadau unwaith y dechreuodd ymgeiswyr ddeall beth fyddai'r uchafsymiau rhent a delid. Erbyn hyn caiff ceisiadau am fynediad eu dosbarthu yn ôl Mynegai Buddion Amgylcheddol (EBI). Mae'r EBI yn rhoi credydau am amrywiaeth o fathau o reoli tir cadwraethol ac yn cynnwys pwyntiau i ffermwyr sy'n barod i gynnwys eu tir yn y cynllun ar gyfraddau tâl is. Cafwyd dadansoddiad economaidd helaeth o'r cynllun a'r manteision ac mae hyn yn awgrymu budd economaidd net sylweddol.

- BushTender. Mae dau gynllun arbrofol wedi eu cyflwyno yn Awstralia i ddosbarthu contractau ar gyfer adfer gwylltir brodorol ar sail gystadleuol. Roedd y dadansoddiad cychwynnol fel pe bai'n awgrymu buddion sylweddol iawn o'r broses dendro o'i chymharu â chynllun taliadau sefydlog, ond mae dadansoddiad diweddarach yn awgrymu bod y buddion mewn gwirionedd yn llawer llai a'u bod yn dueddol o gwympo mewn cylchoedd tendro olynol. Defnyddiwyd Mynegeion Buddion Amgylcheddol i helpu i dargedu'r buddion amgylcheddol. Dangosodd gweithrediad y cynlluniau bwysigrwydd arweinyddiaeth ac ystyriwyd bod cynnwys 'swyddogion cymunedol' yn hanfodol ar gyfer llwyddo.
- Cydweithfeydd Amgylcheddol Mae'r cydweithfeydd hyn wedi eu datblygu yn yr Iseldiroedd ac maent wedi bod yn llwyddiannus wrth annog ffermwyr i gymryd rhan mewn cynlluniau amaeth-amgylchedd ac i gyflwyno ymagweddau mwy arloesol at ffermio amgylcheddol sensitif. Ceir awgrym hefyd y gallant fod yn fwy effeithiol na llywodraethau wrth blismona cynlluniau. Fodd bynnag, ceir gwendidau, megis yr angen am adeiladu ymddiriedaeth, anawsterau wrth bennu lefelau taliadau a chynllunio strwythurau cyfreithiol a gweinyddol effeithiol, yn ogystal â sicrhau buddion ar gyfer yr hirdymor. Dylid ymchwilio ymhellach i botensial yr ymagwedd hon.

Mae'n ymddangos bod rhywfaint o gydgyfeirio mesurau amaeth-amgylchedd yng ngwledydd yr OECD. Yn enwedig, canolbwyntir mwyfwy ar gynlluniau â'r nod o ddarparu ystod ehangach o fanteision amgylcheddol. Mae profiad yn awgrymu nad yw tendro cystadleuol yn darparu'r cynnydd hirdymor mewn cost-effeithiolrwydd y gobeithiwyd ei gael – ond gall sgorio yn ôl EBI fod yn fodd i dargedu cynlluniau ar fuddion blaenoriaethol a gall gynnwys elfen o gystadleuaeth ynglŷn â phris (yn enwedig lle mae gan gyfranogion y dewis i gynnig pris rhatach). Ymhlith prif themâu'r astudiaethau achos mae: i) cydlynu'r broses o benderfynu ymhlith ffermwyr; ii) sicrhau buddion cadwraeth trwy brynu hawliau eiddo; neu iii) defnyddio mecanweithiau dyrannu mwy cystadleuol..

Lefel y taliad

Mewn egwyddor, dylid gwneud taliadau yn ôl y canlyniadau a gyflawnir (canlyniadau amgylcheddol) gan y byddai hyn yn rhoi'r arwydd cliriaf posibl i ffermwyr. Mewn gwirionedd, fodd bynnag, gall canlyniadau fod yn anodd eu mesur. O ganlyniad, mae taliadau wedi eu gwneud fel arfer yn gyfnewid am newidiadau penodol ynglŷn â sut mae tir yn cael ei reoli. Pennwyd lefelau taliadau ar gyfer buddion cyhoeddus amaeth-amgylchedd gan y llywodraeth ar sail amcangyfrif o'r incwm a ildiwyd a'r costau fel canlyniad i'r ymrwymiadau sy'n ofynnol dan y cynllun. Dan Reoliad Datblygu Gwledig presennol yr UE (1698/05), mae taliadau amaeth-amgylchedd yn dal i gael eu cysylltu â'r incwm a ildiwyd (mae'r egwyddor hon wedi ei chynnwys ym Mlwch Gwyrdd Sefydliad Masnach y Byd). Mae'r ddibyniaeth ar incwm a lidiwyd yn adlewyrchu'r sefyllfa pan gyflwynwyd y rhan fwyaf o gynlluniau amaeth-amgylchedd, ond mae'r sefyllfa rywfaint yn wahanol unwaith y bydd gweithgareddau amaethyddol yn dechrau colli arian. Mewn achosion fel hyn, nid oes

unrhyw 'incwm a ildiwyd'. Fodd bynnag, mae yna 'gost cyfle' o hyd yn nhermau'r adnoddau sydd eu hangen er mwyn gwneud y gweithgaredd amaethyddol angenrheidiol (gan y gellid fel arall drosglwyddo'r adnoddau hyn i ryw ddefnydd arall). Y gost cyfle hon, mewn egwyddor, yw'r incwm a ildiwyd.

Fodd bynnag, mae ymagwedd o'r fath yn cymryd yn ganiataol fod yna fusnes hyfyw i wneud y gwaith amaeth-amgylchedd. Lle nad yw busnes yn hyfyw, ni fydd darparu'r math presennol o daliadau amaeth-amgylchedd (boed yn seiliedig ar incwm a ildiwyd neu ar gost cyfle'r newidiadau sy'n gysylltiedig â mynediad i gynllun amaeth-amgylchedd) yn gwella'r sefyllfa. Gellid gwella'r sefyllfa, fodd bynnag, pe bai taliadau amaeth-amgylchedd yn rhoi mwy o ystyriaeth i lefel y costau sefydlog sydd ei hangen er mwyn darparu'r math o weithgaredd ffermio sy'n angenrheidiol ar gyfer y canlyniad amgylcheddol a ddymunir. Mae angen gwneud rhagor o waith ar y costau amrywiol a sefydlog sy'n berthnasol i wahanol sefyllfaoedd ffermio, yn enwedig perthynas y costau hyn â'r lefel o weithgaredd ffermio sydd ei angen er mwyn darparu'r mathau o fuddion cyhoeddus amgylcheddol sydd eu hangen. Gallai ymagwedd o'r fath fod yn sail ar gyfer asesu'r lefelau taliadau mwyaf priodol sydd eu hangen er mwyn cynnal pa weithgaredd bynnag sydd ei angen er mwyn cyflawni'r amcanion amgylcheddol. Ar hyn o bryd, fodd bynnag, gall cynnal cynhyrchiant amaethyddol yn aml gael ei bennu gan sefyllfa ariannol holl deulu'r fferm. Er enghraifft, gall fod cysylltiadau agosach nag a gydnabyddir yn gyffredinol rhwng cefnogaeth economaidd i deuluoedd mewn ardaloedd gwledig a gwarchod amgylcheddau gwledig, lle mae'r prif fygythiad yn ymwneud â chymryd tir allan o ryw fath o reolaeth. Felly, gall cymorth ar gyfer datblygu economaidd gwledig ehangach fod o gymorth wrth gynnal rheoli tir cyhyd ag y gall hyn gynnig ffynonellau incwm newydd neu well i deuluoedd fferm unigol.

Datblygu senarios credadwy ar gyfer y dyfodol.
Amcan y senarios yw nodi'r amodau posibl y bydd cynlluniau amaeth-amgylchedd yn gweithredu oddi tanynt, a'r heriau y gellir eu hwynebu wrth gynnal y ddarpariaeth o fuddion cyhoeddus yng nghefn gwlad. Mae yna ddau fath sylfaenol o yrrwr: yr adenillion ariannol sydd ar gael i ddefnyddiau eraill o'r tir a'r cyd-destun amaeth-amgylchedd a pholisi amgylcheddol. Mae hyn yn awgrymu pedwar senario posibl:

- **'Rheoledig'** – Adenillion Economaidd Uchel a Pholisi Amaeth-amgylchedd Gweithredol. Mae hyn yn gysylltiedig â thir sy'n cael ei ffermio'n ddwys, ond mae'r polisi amaeth-amgylchedd yn gweithredu er mwyn gwarchod yr amgylchedd rhag difrod.
- **'Wedi'i Ecsploetio' -** Adenillion Economaidd Uchel a Pholisi Amaeth-amgylchedd Anweithredol. Mae hyn yn gysylltiedig â defnydd dwys o dir, ond mae bygythiad y caiff yr amgylchedd ei ddiraddio yn absenoldeb cymhellion amgylcheddol.
- **'Gwylltineb' -** Adenillion Economaidd Isel a Pholisi Amaeth-amgylchedd Gweithredol. Mae llai o bwysau ar y tir oherwydd yr adenillion ariannol is. Ynghyd â pholisi amaeth-amgylchedd gweithredol, mae hyn yn arwain at amgylchedd wedi ei reoli'n dda.
- **'Wedi'i esgeuluso' - Adenillion Economaidd Uchel a Pholisi Amaeth-amgylchedd Anweithredol.** Byddai adenillion isel yn golygu y gellid defnyddio tir yn ddwys iawn neu hyd yn oed ei adael heb ei ddefnyddio. Yn absenoldeb polisi amaeth-amgylchedd cryf, gall tir gael ei adael gan arwain at amrywiaeth o enillion a cholledion amgylcheddol gan ddibynnu ar y cyd-destun penodol.

Trafodaeth o'r meini prawf ar gyfer gwerthuso arloesiadau amaeth-amgylchedd yn y DG.
Nodir nifer o feini prawf yn sail ar gyfer asesu arloesiadau posibl, sef:

- Effeithiau Amgylcheddol
- Trachywiredd (effeithlonrwydd llai costau trafodion)
- Costau trafodion
- Cymhellion dynamig (cymhellion/hyblygrwydd i ymateb i amodau newidiol)
- Diogelu rhag newid yn y dyfodol
- Trosoliad (adnoddau o ffynonellau anllywodraethol)
- Hawliau eiddo a derbynioldeb ehangach.

Arloesiadau amaeth-amgylchedd posibl a'u cyfraniad
Mae'r adran hon yn asesu arloesiadau posibl gan ddefnyddio'r meini prawf uchod yn wyneb y senarios eraill.

- Creu amgylchedd cydweithredol: Gall y cyd-destun lle mae ffermwyr yn gwneud penderfyniadau ynglŷn â chyfranogi mewn cynlluniau fod yn ffactor pwysig. Mae cydweithfeydd amgylcheddol yr Iseldiroedd a'r profiad o Landcare yn Awstralia yn awgrymu y gellir addasu sefydliadau i gynnwys budd-ddeiliaid a hyrwyddo cyfranogiad ffermwyr dan amodau gwahanol.
- Contractau ar y cyd: Mewn rhai cyd-destunau bydd yn bwysig hyrwyddo cytundeb mwy ffurfiol ymhlith cyfranogwyr cynlluniau amaeth-amgylchedd. Gall contractau ar y cyd alluogi grwpiau o ffermwyr i bennu dyraniadau costau a gweithgareddau ymhlith ei gilydd. Mae'r potensial ganddynt i weithio mewn nifer o senarios.
- Tendro ar gyfer prynu cost-effeithiol: Fel y nodwyd, mae'r buddion o dendro'n llai amlwg na'r disgwyl. Mae angen mwy o waith cyn i'r ymagwedd hon gynnig ffordd ymlaen ar unwaith i gynlluniau amaeth-amgylchedd yn y DG.
- Prynu tir gyda rheolaeth hirdymor ac arbenigol: Yn wyneb ansicrwydd ynghylch amodau cynhyrchu amaethyddol yn y dyfodol, mae'n bosibl iawn y gall fod enillion i'w cael o sicrhau'r buddion cadwraeth hynny a gafwyd hyd yma a thrwy warantu rheolaeth sensitif ar safleoedd critigol. Gellir cyflawni hyn trwy brynu tir, ond mae costau cychwynnol ymagwedd o'r fath yn uchel.
- Rheoleiddio: Ni chymerir yn ganiataol bob amser fod gan ffermwyr yr hawl i wneud newidiadau i ddefnydd a rheolaeth tir ac ar adegau, rheoleiddio fydd y mecanwaith priodol. Gall rheoleiddio fod yn arf rhatach ond cymharol ddi-fin.
- Ymhlith ffynonellau ariannu eraill mae creu marchnadoedd newydd ac ariannu lleol. Gall fod yna ffyrdd eraill o godi arian ar gyfer cynlluniau amaeth-amgylchedd. Mae angen mwy o waith i nodi'r dewisiadau sydd ar gael a'u heffeithiau posibl ar ansawdd amgylcheddol.
- Cyfamodau a beichiau cadwraeth: Defnyddir hawddfreintiau cadwraeth yn helaeth gan Ymddiriedolaethau Tir yn yr Unol Daleithiau fel modd i sefydliadau preifat hyrwyddo gwarchodaeth amgylcheddol. Mae'n ymddangos y byddai potensial i hyn yn y DG dan amgylchiadau go wahanol. Nid yw'n glir a ydy'r ddarpariaeth bresennol ar gyfer beichiau cadwraeth yn cynnig y posibilrwydd hwn yn yr Alban.
- Cynhyrchu cynlluniau amaeth-amgylchedd: Mae cynlluniau amaeth-amgylchedd yn cynnig manteision amgylcheddol a all gynnal ystod o amcanion llywodraeth, a werthfawrogir yn eu tro gan amrywiaeth o fudd-ddeiliaid. Mae hyn yn awgrymu y dylid cynrychioli'r buddiannau hyn mewn rhyw fath o broses cynllunio amaeth-amgylchedd.
- Ailgydbwyso cynlluniau lefel mynediad: Mae'r cynlluniau lefel mynediad wedi sefydlu fframwaith â chostau gweinyddu cymharol isel. Dan senarios ariannu parhaus, gellid ail-gydbwyso'r rhain trwy newid y dewisiadau sydd ar gael a'r pwyntiau a ddyfernir

amdanynt. Gan ystyried y gwahaniaethau mewn lefelau cyfranogi rhwng rhanbarthau, mae'n ddigon posibl y bydd yn briodol cynnig dewisiadau gwahanol mewn rhanbarthau gwahanol.

Dwy ymagwedd ar gyfer datblygu cynlluniau amaeth-amgylchedd ymhellach

3. Datblygu ac ail-gydbwyso cynlluniau lefel mynediad:

Mae gan gynlluniau lefel mynediad y potensial i wneud cyfraniad mwy sylweddol i ansawdd amgylcheddol. Mae dau fater polisi penodol y gallent fynd i'r afael â nhw. Mae datgysylltu taliadau cynnal amaethyddol yn gadael neilltuo heb unrhyw sail resymegol i reoli cyflenwad ac mae'n fwy na thebyg y caiff ei ddirwyn i ben yn raddol. Fodd bynnag, dangoswyd ei fod yn hyrwyddo manteision amgylcheddol. Ar yr un pryd, mae nifer o ddalgylchoedd afonydd mewn perygl o fethu cyrraedd safonau'r Gyfarwyddeb Fframwaith Ddŵr oherwydd llygredd tryloyw. Gallai cynlluniau ychwanegu lefel mynediad estynedig, wedi eu gweithredu o bosibl yn ôl Mynegai Ansawdd Amgylcheddol, ddarparu mecanwaith ar gyfer mynd i'r afael â'r amcanion polisi amgylcheddol hyn. Bydd angen mwy o arian gan y llywodraeth ar gyfer cynlluniau o'r fath.

4. Cefn gwlad gwydn

Un o'r prif fygythiadau i amgylcheddau amaethyddol yw y gellid colli llawer o'r cynnydd a gafwyd dros yr ugain mlynedd diwethaf os bydd prisiau nwyddau'n dal i godi ac oni fydd ariannu ar gyfer y cynlluniau amaeth-amgylchedd presennol yn cynyddu'n gyfatebol. Mae'r risg yn berthnasol i nodweddion tirwedd a bioamrywiaeth yn y fan a'r lle, ond hefyd i'r cyfalaf cymdeithasol (ar ffurf gwybodaeth, sgiliau a sefydliadau) a gronnwyd trwy weithredu'r cynlluniau amaeth-amgylchedd presennol. Yng nghyd-destun y dyfodol ansicr sy'n wynebu amaethyddiaeth ar hyn o bryd, mae enillion i'w gwneud o drefniadau mwy parhaol, megis trwy brynu tir a thrwy hawddfreintiau cadwraeth. Fodd bynnag, byddai'n rhaid targedu ymagwedd o'r' fath yn ofalus ac mae angen proses gynllunio systematig a chynhwysiant cyhoeddus sylweddol arni. Gallai ymagweddau lleol, yn seiliedig efallai ar y system Ardaloedd Cyd-gymeriad a ddatblygwyd yn Lloegr ac a gefnogir gan brosiectau LEADER gynnig mecanwaith ar gyfer dod â budd-ddeiliaid a thirfeddianwyr ynghyd. Yna gellid nodi blaenoriaethau a'u gweithredu trwy brynu tir a hawddfreintiau wedi eu cydlynu gan gyrff cadwraeth lleol (Ymddiriedolaethau Cadwraeth, Amwynder a Hamdden) yn ogystal â'r trefniadau amaeth-amgylchedd mwy confensiynol.

Casgliadau

Mae cynlluniau amaeth-amgylchedd yn wynebu cyfnod o ansicrwydd, yng nghyd-destun polisi amgylcheddol diweddar a newidiadau i'r polisi amaeth-amgylchedd, ac o ran y posibilrwydd o brisiau nwyddau llawer uwch yn y dyfodol. Mae hefyd yn debygol y caiff neilltuo ei ddirwyn i ben ac y collir ei fanteision amgylcheddol. Mae hyn yn creu her bosibl i bolisi amaeth-amgylchedd a gallai fygwth yr enillion cadwraeth a ddarparwyd gan gynlluniau amaeth-amgylchedd dros yr ugain mlynedd diwethaf. Mae'n awgrymu y gall fod yn ddoeth geisio 'cloi' rhai o'r enillion a gafwyd gan gynlluniau amaeth-amgylchedd i mewn, er bod cefnogaeth ac arian yn dal i ddod o'r PAC.

Mae prif gasgliadau'r astudiaeth hon fel a ganlyn:

- Gall cynlluniau talu-yn-ôl-canlyniadau fod yn ddewis gwerthfawr yn lle'r cynlluniau talu presennol, ond mae angen rhagor o waith ar gynllunio a gweithredu'r cynlluniau.

- Mae angen rhagor o wybodaeth ynghylch costau amrywiol a sefydlog y dewisiadau amaeth-amgylchedd sy'n wynebu'r ffermwyr hynny y mae eu busnesau'n darparu incymau isel, a lle nad yw busnesau'n hyfyw, mae'n debygol y bydd yn rhaid i gynlluniau amaeth-amgylchedd gymryd costau sefydlog ac amrywiol i ystyriaeth os yw tir i'w ddefnyddio'n gynhyrchiol o hyd.
- Mae nifer o arloesiadau a dulliau eraill mewn gwledydd eraill sy'n awgrymu ffyrdd o ddatblygu polisi yn y DG.
- Mae mabwysiadu cynlluniau lefel mynediad yn y DG wedi sefydlu fframwaith y gellid ei ddatblygu ymhellach i fynd i'r afael â nifer o amcanion polisi'r llywodraeth.
- Mae potensial hefyd ar gyfer datblygu rhagor o fentrau cadwraeth gwledig lleol trwy broses sy'n dod â phartïon â diddordeb ynghyd i nodi blaenoriaethau ac yna'n defnyddio prynu tir, hawddfreintiau, a'r mecanweithiau cynlluniau amaeth-amgylchedd presennol er mwyn cyflawni amcanion lleol.

Mae angen rhagor o ymchwil ynglŷn â nifer o agweddau ar arloesiadau'r cynlluniau posibl a adolygir yn yr adroddiad hwn. Mae llawer o wledydd yn ymwneud â datblygu cynlluniau amaeth-amgylchedd, a'r amcanion yn aml yn debyg iawn. Mae'n bwysig dysgu o'r profiad hwn er mwyn trwytho datblygiad cynlluniau amaeth-amgylchedd yn y DG yn y dyfodol.

Abbreviations

AE	Agri-Environment
AES	Agri-Environment Scheme
Ag.	Agricultural
ALR	Auction for Landscape Recovery (in Australia)
BAP	Biodiversity Action Plan
CAP	Common Agricultural Policy (of the EU)
CART	Conservation, Amenity and Recreation Trusts
CCW	Countryside Council for Wales
CRER	Centre for Rural Economics Research, University of Cambridge
CRP	Conservation Reserve Program (of the USA)
CSS	Countryside Stewardship Scheme (in England)
DLDS	Danish Land Development Service
DEFRA	Department for the Environment, Food and Rural Affairs
EBI	Environmental Benefits Index (various)
ELS	Entry Level Scheme (in England)
ESA	Environmentally Sensitive Area
EU	European Union
FAO	Food and Agriculture Organisation (of the United Nations)
FBS	Farm Business Survey
FC	Fixed Costs (of a business: those that do not vary with output)
FSA	Farm Services Agency (of the USDA; delivers the CRP)
GAEC	Good Agricultural and Environmental Condition (required by the SPS)
GBP	Pounds Sterling (UK currency)
GIS	Geographic Information System
GM	Gross Margin
ha	hectares
HFA	Hill Farm Allowance
HLS	Higher Level Stewardship (scheme in England)
JCA	Joint Character Area
LFA	Less Favoured Area (an EU designation)
m	metres
M	Million
n/a	Not Applicable

NEN	National Ecological Network (of the Netherlands)
NGO	Non-Governmental Organisation
NM	Net Margin
OECD	Organisation for Economic Cooperation and Development
PSA	Public Service Agreement (a target for government departments)
RDP	Rural Development Programme (of the EU)
RDPE	Rural Development Plan in England (implementation of RDR)
RDR	Rural Development Regulation (of the EU)
RSS	Rural Stewardship Scheme (in Scotland)
SFP	Single Farm Payment (term formerly used to describe the SPS)
SPS	Single Payment Scheme (of the CAP)
SSSI	Site of Special Scientific Interest
SMRs	Statutory Management Requirements (of the EU)
UK	United Kingdom of Great Britain and Northern Ireland
US / USA	United States of America
USDA	United States Department for Agriculture
WFD	Water Framework Directive (of the EU)
WTO	World Trade Organisation
WTP	Willingness To Pay

1. Introduction

Agri-environment policy can be seen as dating from the mid-1980s and so we have just over 20 years experience of implementing and operating a variety of schemes. The 1985 European Structures Regulation (797/85) allowed member states to provide funding for schemes which contributed towards the introduction or continued use of agricultural production practices, whilst being compatible with the requirements of conserving the natural habitat, and ensuring an adequate income for farmers. Environmentally Sensitive Areas were introduced in England following the Agriculture Act 1986, as well as in other parts of the UK and other European member states. But this is not just a feature of policy in the UK, or even of the European Union. Similar environmental concerns and issues have been addressed also in the United States and Australia. In the United States, the Food Security Act of 1985 authorised the Conservation Reserve Program, with a goal of retiring 45 million acres of highly erodible land. In Australia, within a very different agricultural policy context, the Landcare movement dates back to 1986.

These beginnings have seen considerable evolution and development since the mid 1980s. Within the UK, there has been a shift from policies designed primarily to hold back the pressures for agricultural intensification and the consequent environmental damage within designated areas, towards more general policies that aim to promote environmental enhancement. Within the US, concerns have widened from a focus on soil erosion to a wider concern to promote higher environmental standards, both on land retired from agriculture as well as on farmed land. In Australia, Landcare has extended across the country and come to include a broader range of environmental values. In fact, there are signs of some degree of international coalescence of agri-environment policies, with greater tailoring (to public demands) and targeting (on specific areas) in countries where there have been higher levels of agricultural protection and the introduction of targeted schemes in countries that have had low levels of protection.

While particular objectives and contexts vary, all countries face common problems in introducing and developing agri-environmental policy:

- the public good nature of at least some of the potential benefits arising from different approaches to the management of farmland,
- a need to identify potential environmental improvements that are valued by the public and the ways in which land management should be changed in order to deliver them,
- an asymmetry in information about costs available to government and the landholder undertaking the management,
- a desire to co-ordinate land management at a landscape scale and
- the issue of how best to secure environmental gains into the future.

There is thus potential to learn both from the experience of schemes introduced within the UK as well as from schemes and approaches in other countries.

Context for the research

Within the European Union, the past couple of years have seen major changes in both the Common Agricultural Policy and in rural development policy. The Single Payment Scheme (SPS) significantly alters the context within which farm decisions are being taken. A significant proportion of farm support payments are no longer affected by current production decisions, and this clearly affects the incentives influencing farmers.

European rural development policy is also being reformed under the Council Regulation (EC) No1689/2005 on support for rural development by the European Agricultural Fund for Rural Development. This introduces four 'axes':

- Axis 1: Improving the competitiveness of the farming and forestry sectors
  - With a minimum of 10% of European funding
- Axis 2: Improving the environment and the countryside
  - With a minimum of 25% European funding
- Axis 3: Rural quality of life and diversification of the rural economy
  - With a minimum of 10% of European funding
- Axis 4: Applies the LEADER approach in support of Axes 1-3
  - With a minimum of 5% of European funding

Axis 4 requires that a minimum of 5% of funding on the issues covered by Axes 1 – 3 shall adopt a 'LEADER' approach. That is to say that it must be based on innovative, multi-sectoral, area-based local development strategies. The new programme was due to run from January 2007 to December 2013, but implementation has been delayed pending the introduction of a European Voluntary Modulation regulation.

Within the UK, there have also been changes to agri-environment schemes, especially with the regard to the introduction of the broad and shallow entry-level schemes. These are intended to widen the option to participate in schemes to all farmers and shift the emphasis away from payments targeted at changing behaviour towards payments for services provided. They also reflect political reality - post modulation there is a realisation that if all farmers are modulated then all farmers have to have the chance to participate in what modulation receipts are spent on. While the demand for nature conservation and landscape benefits from rural land continues, there has been increased attention in the UK on resource protection, particularly driven by the requirement being introduced under the EU Water Framework Directive. At the same time, there are signs of increases in the levels of commodity prices and a new debate about the potential role of agriculture in providing for renewable energy production. These issues raise the possibility of renewed pressure on agricultural land uses.

Objective

The objective for the project is to fundamentally re-examine the way in which countryside public good objectives can be delivered in the context of an uncertain future for agriculture.

Outline of the report

The recent introduction of an entry level scheme approach to agri-environment policy represents a new direction. We have undertaken an analysis of the Entry Level Scheme in England to assess the way in which options have been taken up, the influences on take-up and some options for its further development.

Agri-environment schemes have been adopted in a range of different countries over the past twenty years. While many of the primary objectives for the schemes are quite similar, they have been implemented in different ways, some of which have addressed issues that we see as being critical challenges for the further development of agri-environment schemes in the UK. As a result, we have included in this project a number of case studies of different approaches that have been developed elsewhere and we use these to draw out some implications for policy development in the UK.

One issue that has been the subject of considerable discussion is the way in which scheme payments should be determined. The context of agri-environment schemes has changed significantly since they were first introduced, as have their objectives. We therefore review the issues and the alternative ways in which payments might be implemented in the future.

In considering how agri-environment schemes might be developed, it is important to consider the possible contexts within which schemes will have to operate in future. One way of exploring future possibilities is to set out scenarios that capture the main factors that will be of importance to scheme operation. We therefore develop four scenarios based on two sets of drivers and discuss their implications for the operation and effectiveness of agri-environment schemes. It is also important to set out explicit criteria against which potential scheme innovations may be assessed. We identify seven criteria and explain their significance.

We then draw together the potential scheme innovations that have been identified from the case studies and other material, as well as the four future scenarios and seven scheme evaluation criteria. This provides an opportunity for extensive discussion of policy options and their potential application.

Finally we offer some conclusions arising from the analysis and suggest some ways forward.

2. Theory and policy approaches to public goods

Pure public goods are defined in terms of being 'non-excludable', once they are provided they are available to all, and 'non-rival' consumption by one consumer does not reduce the value of the good available for consumption by other consumers. The classic example in economics is that of a lighthouse. Once established, it is impossible to exclude ships from benefiting from its light and the visibility of the light is not reduced by the presence of other ships in the area. An example more relevant to this particular study is of the existence value for wildlife, when people value the knowledge that a particular species is being protected, even though they have no expectation of deriving any sort of direct benefit from it. This generates benefits to all who have this knowledge. It would generally be difficult to exclude people from knowing about the species and, we assume, that the knowledge being held by one person does not diminish its value to another. Given public goods with these characteristics, it is not possible for private producers to make a profit from their provision. Given that once the goods are produced it is impossible to exclude anyone from enjoying them, it is clearly not possible to obtain revenue from their sale. This has the consequence that they are not provided by a private market, even though their value may exceed the costs of production. There is thus a 'missing market' and a potential rationale for provision by government.

It is possible in some circumstances to make certain changes that can facilitate private provision. Non-excludability arises due to high transactions costs. For example, in theory it could be possible to exclude ships from benefiting from a lighthouse without paying by setting up an exclusion zone from where the light may be seen and then charging for entry into the zone. But the costs of administering such a system, *i.e.* the transactions' costs, would far outweigh the potential benefits and make this approach unfeasible. In practice then, there are few 'pure' public goods; rather there are different goods facing different levels of transactions costs. In the context of rural land use, we refer to these goods as countryside goods. These equate to what the OECD would call 'non-commodity outputs'.

This suggests that in some cases there will be potential for at least some degree of private sector provision but that this may depend on some sort of technical or institutional changes in order to make it happen. But this may typically not deliver an 'optimal' level of provision, *i.e.* where the marginal social costs of provision equal the marginal social benefits. This approach suggests that it may be possible and useful to undertake economic valuation studies in order to assess the value of the benefits delivered by agri-environment schemes. Against these benefits, it is necessary to recognise the full costs of provision, including both the costs incurred by land managers and the costs incurred by government in operating a potential scheme. In this respect, there are likely to be trade-offs between 'precision' and transactions costs. Vatn (2002) defines a 'precise' solution as being reached when the standard conditions for optimality are met in the production of the good (*i.e.* marginal cost equals marginal benefit) and thus precision represents the closeness to optimality in those terms. Transactions' costs are the costs involved in establishing and running a policy: collecting information, formulating contracts and monitoring and enforcing them. These are incurred both by government and by the private actors who are affected by the policy. It should be noted that many transaction costs, especially in relation to compliance, are currently determined by EU regulations, so there is little scope to change these requirements in the short to medium term.

However the problem is characterised, there remain a number of fundamental challenges to the design and implementation of agri-environment schemes.

- The demand for countryside goods remains uncertain. The absence of any market price information means that their value cannot be imputed from market transactions. Quantification of the goods is perhaps easier for biodiversity where the rarity of particular species or habitats within particular regions can be quantified. However, even simple quantification for some goods, such as for landscapes, may be impossible, where assessment of demand relies on the expressed preferences of those who experience them. The goods typically have multiple components whose values may be recognised and appreciated by different groups of the population. Expert opinion also may differ from the preferences indicated by opinion surveys or economic valuation studies.
- Values will depend substantially on the local context within which the countryside goods are provided, both in terms of the supply and the demand side characteristics. Thus local 'prices' will depend on the characteristics and potentials of the local environment, local history and culture, the size of the local population and the interrelationships with other areas, such as in the extent to which people travel into the area to appreciate the countryside goods.
- This indicates a requirement for a significant element of local decision-making to represent local preferences and local production conditions.
- Countryside goods are quite often jointly produced with agricultural commodities, either because of technical relationships or because of economies of scale at the farm level. This brings the debate about the provision of countryside goods into the ambit of the debate about agricultural policy and international trade.
- The spatial scale of production of countryside goods such as landscape or habitats exceeds the size of the average agricultural holding, indicating a requirement for some degree of co-ordination across different holdings.
- The skills and knowledge required for the production of countryside goods differ from those required for agricultural production which indicates a requirement for new approaches to education and for training and advice for land managers.
- The objectives and constraints for agri-environment policy change over time, indicating a need for the development and dissemination of new methods and approaches. This suggests a role for entrepreneurship in developing new types of countryside goods and more cost-effective methods of delivery.

The development of agri-environment policy

There have been some clear shifts in the orientation of agri-environment policy since its introduction in the mid 1980s. The initial context was one in which agricultural intensification was made profitable for farmers through the operation of commodity market support and the aim was to hold back the process of agricultural intensification so as to protect valued aspects of the rural environment. The primary focus was on Environmentally Sensitive Areas (ESAs). The original objective of the ESAs was 'to help conserve those areas of high landscape and/or wildlife value which are vulnerable to changes in farming practices by offering payments to farmers willing to maintain or introduce environmentally beneficial farming practices'(MAFF, 1989).

Agri-environment schemes are implemented in order to promote the provision of countryside goods. We therefore need to establish, not simply the outputs that are sought by the policy, but also the position that would apply if the policy was not to be introduced. We refer to this as the 'counterfactual position'. It is defined in terms of the combination of reference level of property rights, social norms and the economic and financial environment that would determine the types and intensities of farming systems that would be selected by landholders in the absence of specific agri-environmental policies.

Payments for agri-environment schemes are defined against the level of income that could be achieved in the absence of the scheme and are calculated in terms of the income that is foregone by landholders in adopting the conditions of an agri-environment scheme. This principle, adopted in European regulation as well as accepted by the World Trade Organisation, indicates an assumption that landholders hold the property rights to choose the way in which they want to manage the land and that government thus makes payments to persuade them to change their behaviour. However, it clearly assumes that level of profit attained by land managers would be higher in the counterfactual position than it would be in the position with participation in the agri-environment scheme. We return to the issue of payments for agri-environment schemes in Chapter 6 of the report.

The objective of the early agri-environment schemes was thus primarily to prevent change, especially at the 'extensive margin', *i.e.* on areas of land that were brought into more intensive production as a consequence of the support mechanisms offered under agricultural policy. These areas had been identified as representing particularly significant biodiversity and landscape values and vulnerable habitats, such as wetlands and extensive grasslands. There are areas that had been particularly diminished as a consequence of the intensification stimulated by the operation of agricultural policy.

Agri-environment schemes extended the 'voluntary principle' much as had been implemented for management agreements within Sites of Special Scientific Areas (SSSIs) under the Wildlife and Countryside Act 1981. This meant that schemes were voluntary and that payments made to farmers were based on the principle of 'income foregone'. Landholders held the right to make changes in their agricultural systems provided that they met the conditions of good agricultural practice, and should be compensated for any loss of income associated with following scheme prescriptions. This approach thus applies the 'provider gets principle' (OECD, 1999).

Over time the policy emphasis has shifted from one of simply preventing change towards one of seeking environmental enhancement, especially the restoration of environmental values that have been lost as a consequence of agricultural intensification and technical change in the past. This change has been reflected in the introduction both of the Countryside Stewardship Scheme and the development of higher tier contracts within the ESAs. For example, the aim of ESAs in England was modified somewhat to 'protect *and enhance* the rural environment by encouraging environmentally beneficial farming practices in areas of the countryside where the landscape, wildlife and historic interest is of national importance' (emphasis added) (MAFF, 2000).

Similar schemes have been operated in other countries in parallel to these. Tir Cymen was introduced in Wales in 1992 and closed to new entrants in 1998. It was a whole farm scheme promoting positive management of wildlife habitat and usually included capital works. The scheme was voluntary with 10 year agreements. Tir Gofal is a whole farm agri-environment

scheme which has been available throughout Wales since April 1999, replacing Environmentally Sensitive Areas, Tir Cymen, and the Habitat, Moorland and Countryside Access Schemes. The Rural Stewardship Scheme (RSS) in Scotland was designed to encourage farmers, crofters and common grazings committees to adopt environmentally friendly practices and to maintain and enhance particular habitats and landscape features. The scheme is discretionary and applications are ranked against scheme objectives. In Northern Ireland there are Environmentally Sensitive Areas and a Countryside Management Scheme.

The implementation of entry level schemes may then be seen as a third phase in agri-environment policy that extends payments beyond the primary concentration on the extensive margin to include payments across all agricultural land areas in order to alter agricultural production on the most intensively used land. The implication is that the provision of countryside goods can be enhanced both by reducing the intensity of production in more intensively farmed areas, such as by the introduction of buffer strips and the management of linear features such as hedgerows, as well as by supporting farming in less intensively managed areas where this delivered environmental benefits. Furthermore, by allowing all farmers to participate, whether or not they would otherwise have planned to reduce environmental quality by agricultural intensification and without requiring that they actively enhance environmental quality, a right has effectively been established for all farmers to receive payment for the provision of countryside goods, whatever is the counterfactual position.

This takes policy towards an ecosystems services approach. One definition defines ecosystem services as "the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life … In addition to the production of goods, ecosystem services are the actual life-support functions such as cleansing, recycling and renewal, and they confer many intangible aesthetic and cultural benefits as well" (Daily, 1997, 3 quoted in Heal and Barbier, 2006). They are often divided into various categories, such as (de Groot *et al*., 2002):

- Regulation functions (e.g. gas, climate, water pollination)
- Habitat functions (refugium, nursery),
- Production functions (food, raw materials, ornamental)
- Information functions (aesthetic, recreation, cultural, spiritual, scientific)

The entry level schemes support the provision of a variety of services on the assumption that these are public goods and that land managers can expect to be paid for their provision, irrespective of what would be the type of land management in the absence of the payment.

At an international level there are parallels between the direction being taken in the UK and that in the USA where the emphasis has recently shifted from schemes designed to take land out of production (such as the Conservation Reserve Program) towards schemes that seek to influence the management of land in agricultural production (such as the Conservation Security Program). There are also parallels with the debate over the provision of ecosystem services in Australia.

The current policy issues

Two major policy changes have occurred over the past couple of years that substantially alter the current agri-environment policy context. At the EU level the CAP reforms of 2007 and the introduction of the Single Payment Scheme, which substantially decouples direct agricultural support payments from production decisions. This has immediate implications for the levels of agri-environmental payments in that the altered production levels associated with participation in many agri-environmental schemes do not lead to any income being foregone. The SPS also has wider implications in that it may undermine the basic profitability of entire farming systems that are necessary in order to maintain desired patterns of land management.

At the UK level, a second major policy change relates to agri-environment schemes themselves with the introduction of so-called "entry level schemes", the Entry Level Scheme in England, the Land Management Contract Menu Scheme in Scotland and Tir Cynnal in Wales . These schemes offer relatively low levels of payment, based on enabling farmers across the UK, to undertake a wide range of simple environmental management practices on a non-competitive basis.

Further uncertainty arises in relation to the future state of agricultural commodity markets. High oil prices and increased concerns for energy security have prompted a very substantial investment in biofuels in the Unites States, leading to knock-on effects on those livestock sectors dependent on arable inputs. Reductions in the maize growing area have caused livestock producers to switch to wheat – and driven up the price of wheat for human consumption. At the same time there are uncertainties for food production capacity at a global scale associated with the implications of climate change as a result of extreme weather events, spread of insect pests, increased competition for water. More generally there are concerns that modern land use practices have increased short-term supplies of material goods at the expense of undermining ecosystem services in the long run (Foley, *et al.,* 2005). The current commodity price rises may signal a long term shift following an extended period of relatively low prices. Higher commodity prices may encourage farmers to opt out of agri-environment schemes in the UK unless payment rates are increased. In the face of these changes it is appropriate to take a new look at the challenges facing agri-environment schemes and the options for their further development in the future.

3. Evidence of demand for public goods

Countryside goods and issues

The rural environment generates a wide variety of benefits with various public good attributes. These take on a range of forms and are appreciated in different ways by different groups of people. They would, for instance, include:

* Biodiversity and landscape conservation
    - Protection of rare species and habitats
    - Amenity and cultural values of wildlife and habitats
    - Aesthetic, historic and cultural values of landscapes

* Resource protection and management
    - soil and water quality
    - carbon storage
    - flood protection

* Public access and amenity

At the same time, a range of existing methodologies can help reveal some aspects of the ways in which these public goods are valued, including:

- Measuring public opinion
- Economic valuation - (Prices (incl. hedonic[1], travel cost, etc), Willingness To Pay (WTP), Choice Experiments)
- Assertions by leaders and campaigning organisations
- Need for ecosystem services

The state-of-the-art in assessing demand for public goods is still relatively undeveloped. Hall *et al* (2004) stated in their review of the evidence and methods for assessing public demands from the countryside, that "*...surprisingly little is known about how the public would prefer support [for countryside goods] to be allocated.*" While there have been studies which have attempted to ask what the public wants, most of these have been subject to potential bias by the vested interests of the, largely campaigning, groups who commissioned the surveys (Hall *et al* 2004). Surveys and polls have weaknesses and may be biased by the prevailing news background; level of information provided; framing (open questions or forced trade-offs); sample chosen; and nature of the interviewer/s. Thus the attitudes elicited by surveys may have only a tenuous relationship to the attitudes that would apply in a world of truly rational economic agents (people).

Many campaigning groups, such as the WWF and Countryside Link, take strong positions on what environmental goods one ought (in their opinion) to be able to obtain get from the countryside. Political leaders and farmers groups similarly take direction from their

[1] In hedonic pricing the value of real estate is a function of features that please people. For example the most highly prized housing is said to be: on a hill-side, overlooking water, and close to trees - this is thought to be a consequence of our evolutionary origins as hunter-gatherers.

constituents, collect support and lobby, accordingly. Neither Eurobarometer, nor the British Social Attitudes survey, have attempted to discover in any detail what the public would like to see agri-environment resources expended on. In the light of this and the general paucity of material on public demands, this could be an issue for further research.

While commissioned polls may have weaknesses, the environment is generally found to remain as an issue of serious concern to the public. For example the topics "environment/ pollution" and "countryside/ rural life" combined have consistently ranked highly in the top 3 issues facing Britain today cited by members of the public. Currently they rank sixth out of forty (unprompted) issues and are ranked above "the economy", "drug abuse" and "housing" (Ipsos-MORI 2007). In fact, in a few months out of the last twenty years, "pollution/ environment" was actually ranked as the most important issue facing Britain. Given this concern it is not surprising that campaigners have responded by proposing a wide variety of solutions.

Additional evidence is provided by those who seek to enjoy the benefits of the rural environment. Both trips to the countryside and levels of rural tourism, are strong indicators of demand for environmental goods. Over 20 per cent of adults make a trip to visit the countryside in any one week - a total of over 770 million trips to rural destinations in 2005 (Natural England 2007). Similarly, the major economic impact of the foot and mouth epidemic of 2001 arose from reduced rural tourism rather than the direct impacts on farming (tourism receipts were reduced by £2 to 3 billion whilst agricultural receipts reduced by £0.8 to 2.4 billion - BBC news report: 29 August, 2001).

Le Quesne and McNally (2005) provide a succinct guide to economic valuation of environmental goods. In this methodology monetary values are placed on the uses of environmental goods, as well as non-use values (which arise from utility derived from 'knowing it is there', as well as option and bequest values)[2]. In most ecological valuations non-use values are by far the largest component - WTP for 'knowing it is there' can be quite large and at an aggregate level far exceed use values arising from tourism, industry or farming.

There is a considerable range of economic valuation studies highlighting the benefits of the rural environment. Work for Defra by Hanley *et al.* (2001) as more recently updated by Oglethorpe (2005) has drawn together much of the valuation work and assimilated this into a benefits transfer analysis[3] of the regional demands for various environmental landscape features. Some results are illustrated in Table 3.1. A review of studies undertaken in other European countries has recently been published by Madureira, *et al.* (2007). Moran *et al* (2004) attempted to assess the preferences of the Scottish public for environmental goods from farming using a sequence of focus groups, mail shot rankings, a choice experiment and an analytical hierarchy process. Generally, they found that there is "*an appetite to see something more delivered from rural policy*" but that the mental model of how the

[2] Utility is the satisfaction derived from consumption or possession of economic goods. Option values are the value placed on the possibility of deriving utility from something at some time in the future - eg an option to buy or sell wheat at some time in the future has a specific value and may be purchased or sold at close to that value. Bequest values arise from the value placed on leaving resources for future generations.

[3] Benefits transfer in economic analysis is where the results of one valuation survey are applied to a different area or to different environmental goods.

countryside should work, that is held by the public, "*is a somewhat idealised and frequently limited perspective*" and that in this context it was not possible to specify an exact set of preferences for all tradeoffs. Especially as time preferences were seen as having important implications, but were not otherwise considered in their study.

Table 3.1 Average willingness to pay for avoidance of a 10% reduction in abundance of landscape features, £ per ha or km by households in English regions

	NE	NW	Y&H	EM	WM	E	SE	SW
Hay Meadow	26.25	27.11	35.21	32.16	25.31	88.96	38.46	10.80
Heather Moorland or Heathland	1.66	4.90	2.15	10.91	17.41	55.90	17.47	5.23
Rough Grazing	3.00	4.18	3.87	5.04	7.68	7.35	9.00	4.73
Woodland	6.47	8.64	5.60	5.58	5.66	5.18	3.34	2.54
Headlands	6.89	44.37	7.06	4.63	8.09	8.93	5.70	5.59
Hedgerows	7.91	22.03	7.17	4.97	6.32	8.27	5.54	2.88
Wetland	111.51	104.69	153.19	90.23	138.98	131.14	154.74	145.29

While a substantial number of economic valuation studies have been undertaken, these were compiled at different times, relate to different aspects of the environment and use different methodologies. It is thus difficult to synthesise a more general view from them. Oglethorpe comments on the limited number of studies that were suitable for the benefits transfer study and notes the emphasis on methodological development rather than on building a systematic coverage of environmental values. Thus, given the human limitations (discussed below) that affect valuation of non-use benefits, the precision and usefulness for policy making of such valuations must be open to doubt.

Demand for agri-environmental goods is also revealed by land prices - where houses in rural areas fetch a premium over comparable houses that are not surrounded by a "rural idyll" (as evidenced by hedonic pricing models). "Lifestyle" buyers currently account for as much as 50 per cent of farmland sold and evidently place a premium on owning rural land. There are areas of the UK, for example the fens, where farmland is less valued and parcels remain on offer for longer periods - this again suggests that some agricultural environments are more highly prized than others.

The above observations suggest that there is strong demand for rural environmental goods. However they provide little indication of exactly what the public would like to see more of in rural areas – unfortunately, such data do not help determine exactly which environmental goods, or bundles of goods, are most desired.

From Table 3.2 (below) it can be seen that many studies, which have attempted to define demands for public goods are based on leadership, or assertion, (what the authors think the public wants, or ought to want). Relatively few studies have attempted to assess demand based on open ended questioning or prioritising lists of prompts – although there are with some exceptions, such as some of the surveys and polls reviewed in Hall *et al* (2004). Similarly, while monetary valuation has been attempted for a relatively wide range of public

goods, the reliability and interpretation of the values obtained must be questioned in the light of human biases and failings.

Table 3.2: Selected studies which use a variety of methods to assess demand for public goods from agri-environment schemes.

Method of Assessing Demand	Public Opinion: Surveys/ polls; Deliberative exercises:	Economic Valuation (Prices, WTP - CV, CE)	Assertions (Leadership)	Ecological Analysis (cf. Ecosystem Services)
Studies Covering Several Public Goods	Hall *et al* 2004;	Carlsson *et al* 2003; Hall *et al* 2004; IUCN *et al* 2004; JACOBS 2006; Le Quesne & McNally 2005;	Bignal & Baldock 2002; CRER 2006; EC 2000a & 2000b; EC 2006; EEA 2005b; HRSCEH 2001; Peterson 2003; PCFFF 2002; RSPB 2004; Swales *et al* 2005; Voluntary Initiative 2004; Wildlife and Countryside Link 2001; WWF *et al* 2005;	
Studies concentrating mainly on one Public Good				
Landscape		GHK and GFA-Race 2004;		
Biodiversity		Hanley *et al* 2004;		Carey *et al* 2005; Grime 1973; Kleijn *et al* 2006;
Flood Protection				
Soil and Water Quality		Hökbya and Söderqvist b 2001;		
Public Access		Christie *et al*;		
Social Capital			Fulton and Sanderson 2003; Lockie 2006;	
Resilience to Climate Change			Edwards-Jones *et al* 2006;	

Willingness To Pay (WTP) can be biased by: framing and information provided; cognitive limitations; news background; sample chosen; and interviewer/s. Options are assessed on the basis of: attitudes, norms, and perception of personal efficacy - rather than some measure of utility. Humans face extraordinary challenges in rationally (*i.e.* consistently and logically) choosing between options with different costs and benefits owing to: incorrect evaluation of probabilities (cf. weighting of probabilities); non-fungibility[4] between mental accounts; intractability of preferences; loss aversion or risk aversion; framing/ context; scope/ embedding; salience/ anchoring; preference reversal for WTP or choice (that is: wtp or choice of a, b or c, etc); ill-formed preferences, ignorance or myopia; heterogeneity of preferences; limited cognitive capacity; legal standing with respect to damages. Thus some argue "*it's not worth anything to those unaware of it*" (ill-formed preferences) and others that "*it's only worth as much as you tell them*" (framing). All of these factors together result in what one author described as "*the wild discrepancies found in [valuation] research*".

Despite these weaknesses, monetary valuation can offer (if well conducted) at least some indication of what the public would like to see its' money spent on. In the absence of any other ranking of priorities and methods for offsetting costs one against another, valuation may provide an initial basis on which proposals can be based. These could then be modified in the light of consultation with stakeholders and experts (Sagoff 2004). However, owing to the limitations discussed above, it would seem naïve to think that we could optimise spending on the basis of valuations of non-marketed goods alone.

There may be a sense in which the characterisation of the problem in terms of public goods and missing markets tends to direct attention towards particular policy objectives at the expense of others. An alternative perspective might suggest that the objective for public intervention should be to promote sustainability of the countryside and rural resources. This may be interpreted in terms of securing the supply of ecosystem services against the threats from external shocks (Hodge, 2004). For instance, an obvious threat to biodiversity arises from climate change. This challenges the value of site-based conservation initiatives and suggests that conservation should be given more attention to the creation of a more resilient countryside. This might be promoted by a generally higher standard of environmental management in the wider countryside, linking areas of semi-natural habitat as corridors/networks for wildlife or managing carbon sinks such as wetlands and woodlands. In this context, it is less clear exactly which 'public goods' would be delivered by this type of policy. Many benefits might be realised in terms of "changes avoided" rather than the delivery of specific outputs. Furthermore, in the context of an as-yet incomplete understanding of the operation and linkages amongst ecosystem services, it may not even be apparent which changes have actually been prevented. This alternative perspective suggests that less emphasis might be placed on economic valuation and public preferences in determining the relative priorities to be attached to the alternative types of countryside goods.

The public goods generated from alternative forms of rural land management can be characterised in various ways:

- This may be in terms of what surveys of the public indicate as being wanted, typically in terms of landscape, wildlife and public access.

[4] Money is fungible, in that it can be transferred between accounts and still have the same value, when spending it. But, fifty pounds taken from a person's weekly food budget is likely to have a very different value to fifty pounds taken from the same person's annual holidays budget.

- They may be defined in terms of what 'experts' or Governments judge to be the priority with regard to particular targets, such as ensuring Sites of Special Scientific Interest are in good condition, or reversing declines in an index of farmland birds, or increasing the population of a particular species.
- Or they may represent an action that is deemed as being appropriate in order to prevent an undesirable outcome.

These different approaches towards determining 'value' and setting objectives for government intervention all involve different value judgements in various ways. In some cases the sources of value are relatively explicit and transparent; in others the value judgements are more obscure and less readily identified. In some cases they are made through a political process; in others they emerge from a more bureaucratic process. This is not perhaps surprising given the wide range and variety of different types of public goods that are potentially involved. And it should be recalled that debate about value continues to be a critical area of discourse within the social sciences. Perhaps all that can be expected is a greater element of transparency within an institutional context so that different interests and stakeholders can indicate their own approaches and perceptions and seek to find some measure of agreement. This is what Sagoff (2004) refers to as "*civic engagement in environmental problem solving*". While no single valuation methodology can offer a 'correct' solution, different approaches can make a significant contribution towards assembling and processing information. Thus what is being sought is a pluralistic approach. We return to a discussion of an institutional context that may facilitate this approach in the final section of the report.

Of course, this all depends on whether or not the proposed measures can actually deliver the requisite environmental benefits. In 2001 Kleijn *et al* published a paper in *Nature* which concluded that agri-environment schemes did not protect biodiversity in the Netherlands, and in some cases reduced biodiversity by destroying important habitats. This paper was widely publicised and had considerable impact, which resulted in much reconsideration of agri-environment schemes in the Netherlands. In a subsequent and more wide ranging review, looking at more papers which assessed the effectiveness of agri-environment schemes across Europe, Kleijn and Sutherland (2003) concluded that the picture was more generally positive and that, in more than half the evaluations, the schemes increased biodiversity. Some schemes delivered only marginal benefits , however, whilst a very small number showed negative impacts. More recently, , in the most thorough evaluation of European agri-environment schemes to date, Kleijn *et al* (2006) carried out a series of statistically controlled comparisons involving over 200 paired parcels of land (each pair having one parcel within agri-environment schemes and one control parcel that had not been in any scheme) in five countries. They concluded that all schemes had positive effects on biodiversity that ranged from moderate to marginal. For example plant biodiversity increased by an average of 2 species (ns) in the Netherlands to an average of more than 15 species ($p<.001$) in Germany. In virtually all comparisons fauna also increased in the agri-environment schemes relative to controls.

4. Analysis of the Entry Level Scheme

Introduction to the ELS

The initial proposal for a broad and shallow scheme or an entry-level scheme was put forward by Wildlife Link (Dwyer, 2001) and recommended by the Policy Commission on the Future of Farming and Food (2002). The proposal was evaluated by Defra in the context of a review of agri-environment schemes undertaken in 2002-03 and subsequently adopted within England. There are considerable similarities in approach between the Entry Level Scheme (ELS) in England, the Land Management Contract Menu Scheme in Scotland and Tir Cynnal in Wales. Whilst the focus in this chapter is on the English scheme, similar principles apply to entry-level schemes throughout the UK.

The Entry Level Scheme (ELS) is a 'whole farm scheme' open to all farmers and land managers[5]. It aims to encourage large numbers of farmers and land managers across England to deliver simple environmental management that goes beyond the requirement to maintain land in Good Agricultural and Environmental Condition (GAEC) under the Single Payment Scheme (SPS). It is hoped the ELS will help to:

- Improve water quality and reduce soil erosion – by encouraging management which can help to meet these aims
- Improve conditions for farmland wildlife – including birds, mammals, butterflies and bees;
- Maintain and enhance landscape character – by helping to maintain important features such as traditional field boundaries;
- Protect the historic environment – including archaeological features and artefacts.

Farmers applying for an agreement under the ELS, are initially required to prepare a simple record of features on the farm (called the Farm Environment Record). This is done using the Farm Environment Record (FER) map supplied by Defra's Rural Development Service (RDS - now part of Natural England). Alongside the pre-filled application form and maps, farmers are also given a 'points target' or minimum standard for entry into the scheme. This target is moderated to take account of farm size and is 30 points per hectare, outside of Less Favoured Areas (LFAs) where it is 8 points per ha. There is no minimum holding size for entry into ELS.

Farmers are able to choose from a wide range of options (e.g. hedgerow management, low input grassland, buffer strips, management plans and options to protect soils), covering all farming types. Each option earns 'points' (e.g. 400 points per hectare) towards the points total (see Table 4.2).

Farmers make a legally binding agreement under the ELS to:

a) identify, map and retain their FER features;
b) deliver the options selected in the application form in accordance with the management requirements of the scheme (in Section 3 of Defra 2005); and
c) adhere to all the scheme terms and conditions contained in this handbook, and in particular to follow Good Farming Practice throughout the farm.

[5] This description of the ELS in England is an edited version of that given in the Defra (2005) - Crown ©

Farmers are paid a flat rate of £30 per hectare per year for all eligible land, with the exception of LFA areas where the payment £8 per hectare per year. Acceptance into the scheme is guaranteed providing the farmer can meet the scheme requirements. The ELS is open to all farmers (or land managers) who have control of the land for the full five years of the agreement. Eligible land constitutes all the land and associated field boundaries registered on the Rural Land Register (RLR) that is farmed as one business enterprise and submitted as a single ELS application. Individual applications may include land registered under more than one holding number.

The aim of this chapter is to present information on the way in which the ELS has been adopted and to explore some of the determinants for it. The detailed analysis can be found in Annex I; only a summary is presented here.

The ELS has attracted a considerable number of applications with substantial numbers of farms and areas of land enrolled in the scheme . Some headline figures are shown in Table 4.1.

Table 4.1: ELS headline statistics on 4/08/06.

Category	**hectares**
Total area in agreements under the ELS by 04/08/06	2,648,413
Total farmed area in England	9,168,465
- percentage:	28.9 per cent
	hectares
Arable land taken out of production	29,761
Extensive grassland (LFA) agreed	67,766
Intensive grassland agreed	172,917
Mean area of the 4 management plans	1,637,453
Boundaries being managed	**km of side**
Hedges	208,379
Ditches	59,910

Methodology

Data were obtained for all ELS options with 'Live' agreements in ELS or ELS/HLS, (extracted from the Defra GENESIS GIS system on 4th August 2006. The compilations were carried out using NUTS4[6] boundaries, by Defra's RDS, National GI Unit, (Ref: GIU06-94). There were 22,644 'Live' agreements with ELS options at this time.

ELS options were classified into groups (e.g. arable out of production; ditch options; management plans; etc.) for the purpose of producing summaries of both points (pounds equivalents) purchased and maps of the densities of uptake in districts. These summaries

[6] NUTS4 (districts): Nomenclature Units for Territorial Statistics level 4 - alternatively Unitary Authority and Local Authority Districts: UALADs

were complemented by a statistical analysis of the influence, on ELS uptake, of various agricultural and social variables (e.g. area of cereals grown in district; population density; etc).

Results

As would be expected, arable options are mainly distributed over arable areas - with almost all of the arable out category was accounted for by buffer strips and field corner management. Similarly the boundary options were mainly adopted in areas of the country rich in boundary features. Management plans were mostly taken up the predominantly arable eastern and central areas of the country, with lower rates of uptake in the west, where livestock predominate. Intensive grass options were most adopted in the, livestock rich, west and LFA grass options in the LFA of the north and southwest.

Thus the main drivers explaining area of ELS uptake in districts were the agricultural characteristics of the area. Notably, cereals area and farmed area, along with numbers of grazing livestock units, were strongly associated with increased uptake. Participation in the CSS or ESA reduced uptake, as would be expected because participation in these schemes precludes participation in the ELS. Similarly, large number of relatively small holdings (5 to 50 hectares) within the area also reduced uptake. Possibly because smaller holdings are farmed more intensively or because farmers on larger holdings are better placed to deal with the administrative challenges, especially amongst the earlier entrants into the scheme. Membership of the, predominantly rural, "Coastal and Countryside" ONS social cluster was associated with greater uptake, whereas membership of the "Prospering Southern England" cluster reduced uptake.

Table 4.2: Points bought for all ELS options to 4/8/06

DESCRIPTION	Units Bought to 4/8/06	CODE	UNIT	Points per Unit	Points Bought	% of Points	Cumu -lative
Hedgerow management (on both sides of hedge)	45,786,377	EB1	m	0.22	10,073,003	10.77	10.77
Hedgerow management (on one side of hedge)	50,461,066	EB2	m	0.11	5,550,717	5.94	16.71
Enhanced hedgerow management	18,510,470	EB3	m	0.42	7,774,397	8.32	25.03
Stone faced hedge bank management on both sides	767,599	EB4	m	0.16	122,816	0.13	25.16
Stone faced hedge bank management on one side	808,482	EB5	m	0.08	64,679	0.07	25.23
Ditch management	12,829,412	EB6	m	0.24	3,079,059	3.29	28.52
Half ditch management	7,270,713	EB7	m	0.08	581,657	0.62	29.14
Combined hedge and ditch management (incorporating EB1)	7,473,562	EB8	m	0.38	2,839,954	3.04	32.18
Combined hedge and ditch management (incorporating EB2)	4,686,383	EB9	m	0.26	1,218,460	1.30	33.48
Combined hedge and ditch management (incorporating EB3)	3,673,597	EB10	m	0.56	2,057,214	2.20	35.68
Stone wall protection and maintenance	8,535,468	EB11	m	0.15	1,280,320	1.37	37.05
Protection of in-field trees (arable)	25,046	EC1	tree	12	300,547	0.32	37.37
Protection of in-field trees (grassland)	135,103	EC2	tree	8	1,080,824	1.16	38.53
Maintenance of woodland fences	5,053,047	EC3	m	0.04	202,122	0.22	38.75
Management of woodland edges	5,514	EC4	ha	380	2,095,211	2.24	40.99
Take archaeological features out of cultivation	1,016	ED2	ha	460	467,194	0.50	41.49
Reduce the depth of cultivation on archaeological features	5,430	ED3	ha	60	325,794	0.35	41.84
Management of scrub on archaeological sites	207	ED4	ha	120	24,832	0.03	41.86
Archaeological features on grassland	29,643	ED5	ha	16	474,284	0.51	42.37

DESCRIPTION	Units Bought to 4/8/06	CODE	UNIT	Points per Unit	Points Bought	% of Points	Cumu -lative
2m buffer strips on cultivated land	1,294	EE1	ha	300	388,209	0.42	42.79
4m buffer strips on cultivated land	4,705	EE2	ha	400	1,881,816	2.01	44.80
6m buffer strips on cultivated land	8,798	EE3	ha	400	3,519,085	3.76	48.56
2m buffer strips on intensive grassland	359	EE4	ha	300	107,581	0.12	48.68
4m buffer strips on intensive grassland	512	EE5	ha	400	204,786	0.22	48.90
6m buffer strips on intensive grassland	943	EE6	ha	400	377,388	0.40	49.30
Buffering in-field ponds in improved grassland	105	EE7	ha	400	41,972	0.04	49.34
Buffering in-field ponds in arable land	216	EE8	ha	400	86,367	0.09	49.44
Field corner management	9,042	EF1	ha	400	3,616,961	3.87	53.31
Wild bird seed mixture	2,675	EF2	ha	450	1,203,701	1.29	54.59
Wild bird seed mixture on set-aside land	662	EF3	ha	85	56,247	0.06	54.65
Pollen + nectar flower mixture	1,232	EF4	ha	450	554,539	0.59	55.25
Pollen + nectar flower mixture on set-aside land	170	EF5	ha	85	14,478	0.02	55.26
Over-wintered stubbles	44,633	EF6	ha	120	5,355,985	5.73	60.99
Beetle banks	77	EF7	ha	580	44,948	0.05	61.04
Skylark plots	11,047	EF8	plot	5	55,235	0.06	61.10
Conservation headlands in cereal fields	498	EF9	ha	100	49,796	0.05	61.15
Unfertilised conservation headlands in cereal fields	421	EF10	ha	330	138,874	0.15	61.30
6m Uncropped, cultivated margins on arable land	501	EF11	ha	400	200,519	0.21	61.51
Under sown spring cereals	1,877	EG1	ha	200	375,317	0.40	61.92
Wild bird seed mixture in grassland areas	89	EG2	ha	450	40,126	0.04	61.96
Pollen and nectar seed mixtures in grassland areas	22	EG3	ha	450	9,675	0.01	61.97
Cereals for whole crop silage followed by over-wintered stubbles	623	EG4	ha	230	143,364	0.15	62.12
Brassica fodder crops followed by over-wintered stubbles	4,642	EG5	ha	90	417,791	0.45	62.57
Management of high erosion risk cultivated land	7,340	EJ1	ha	18	132,126	0.14	62.71
Management of maize crops to reduce soil erosion	5,948	EJ2	ha	18	107,069	0.11	62.82
Take field corners out of management	371	EK1	ha	400	148,284	0.16	62.98
Permanent grassland with low inputs	127,920	EK2	ha	85	10,873,171	11.63	74.61
Permanent grassland with very low inputs	40,678	EK3	ha	150	6,101,769	6.53	81.14
Management of rush pastures (outside of LFA)	2,029	EK4	ha	150	304,351	0.33	81.47
Mixed stocking	67,633	EK5	ha	8	541,066	0.58	82.04
Field corner management (LFA land)	208	EL1	ha	100	20,834	0.02	82.07
Manage permanent in-bye grassland with low inputs	31,884	EL2	ha	35	1,115,945	1.19	83.26
Manage in-bye pasture and meadows with very low inputs	7,678	EL3	ha	60	460,661	0.49	83.75
Management of rush pastures (LFA land)	3,553	EL4	ha	60	213,150	0.23	83.98
Enclosed rough grazing	2,219	EL5	ha	35	77,654	0.08	84.06
Moorland and rough Grazing	22,224	EL6	ha	5	111,118	0.12	84.18
Soil management plan	1,688,660	EM1	ha	3	5,065,981	5.42	89.60
Nutrient management plan	1,775,791	EM2	ha	2	3,551,582	3.80	93.40
Manure management plan	1,355,260	EM3	ha	2	2,710,521	2.90	96.30
Crop protection management plan	1,730,104	EM4	ha	2	3,460,207	3.70	100.00

Conclusions

The entry level approach represents a significant development in UK agri-environment schemes. At this stage there are no estimates as to the physical impact that it will have on the ground in terms of changed environmental quality. There may never be reliable estimates

given the near impossibility of establishing with any confidence a reliable counterfactual against which to measure change. The analysis of the English scheme indicates that agricultural conditions are overwhelmingly the major influence on up-take, suggesting that farmers are adopting options that are most consistent with their particular farm circumstances. This is of course to be expected, although there are hints that other factors are also influential

More work needed to bring the analysis up to date so it includes more recent entries into the scheme and explains how uptake patterns relate to other policy objectives, such as those relating to water quality or biodiversity. If the larger farmers were first to enter their land, it will be interesting to see later entrants deliver different scheme prescriptions compared to the initial participants.

There is a basic question as to whether the outputs that may arise from the scheme (based on the combinations of options that have been chosen by the farmers as they entered) represent a good return on public expenditure. It is recognised that the scheme also has a beneficial effect by introducing farmers to the possibility of engaging for the first time in the agri-environment programme and signing whole farms up to a basic level of environmental management. But we anticipate that there is also scope for further development of the ELS framework to promote additional environmental benefits. We return to this issue later in the report.

5. Case Studies

Introduction

Agri-environment schemes have been introduced in parallel across different countries over a similar time period. While there are significant difference in the agricultural conditions, environmental circumstances and policy priorities, there are also important similarities. However, it would appear that schemes have been developed in different countries relatively independently. There is thus merit in learning from the experience that has been gained with agri-environment schemes in other countries to see whether there are lessons that could have relevance for the future development of agri-environment policy in the United Kingdom. The aim here was to concentrate on innovative approaches that relate to issues that are of present concern in the UK. The chosen approach was to commission case studies from academics and researchers who were already closely involved rather than to base the studies simply on the available literature. The studies were chosen from a range of innovations around the world because they represent exemplars from a diversity of practical approaches to delivering environmental goods and paying farmers to do so. In the absence of s systematic study of agri-environment scheme approaches around the world, it is impossible to know to what extent they are representative of the innovations being explored.

Case studies were chosen because they incorporate novel ways of addressing the problems of providing environmental goods. They reflect a mixture of different approaches towards the identification and selection of farmers as well as to the delivery of countryside goods. Issues which have been seen as problematic include:

- competitive tendering (auctions) or fixed payments;
- ensuring enduring benefits (short term contracts, easements, or land purchase);
- connecting up conservation areas (the NEN in the Netherlands); and
- coordinating actions across holdings (Danish Planting Associations).

The Conservation Reserve Program in the USA was chosen as it is probably one of the largest land retirement programs in the world - and one of its main motivating factors is the provision of environmental goods (namely erosion control and providing wildlife habitats).

Each study contact was asked to discuss: the key objectives and approach involved, the operation of the approach in practice; any assessments of its success; and possible lessons for future implementation.

In the end four case studies were commissioned. We include our own summaries[7] of the case studies in the main body of this report, with complete texts located in Annexes II to V.

Collective Hedgerow Schemes - Denmark
Land purchase - Netherlands
Conservation reserve program - USA
Tendering / auctions - Australia

[7] The summaries here were written by the authors of this report (not by the authors of the case studies). Thus, any inaccuracies, errors and omissions here are thus wholly the responsibility of the report authors (IH & MR).

There were a few other issues that seemed to be of potential interest, but in these cases we were unable to commission a suitable case study. Environmental Co-operatives have been of particular note in the Netherlands as are local payments for landscape conservation protection in Austria. We provide a brief summary of some of the issues arising from these programmes in sections 5.5 and 5.6 below.

5.1 Hedgerow planting schemes in Denmark

Anne Grasvholt Busck, University of Copenhagen

The collective hedgerow planting schemes in Denmark date back to excessive heathland reclamations in the 1800s in Western and Northern Jutland, which resulted in sandstorms and severe wind erosion, showing the necessity for shelter belts. This culminated in the formation of the Danish Land Development Service (DLDS) in 1866. The DLDS is a private body devoted to land development and subsidised hedgerow plantings, in particular. Subsidies were initially provided by membership fees and donations, but government support was initiated in 1880. The DLDS encouraged the formation of up to 150 local planting associations over the next century - these were responsible for most hedgerow plantings up to 1980s. The DLDS administered the scheme until 1988 when responsibility was transferred to the umbrella body of the local planting associations: the Danish Planting Association. At the same time the DLDS lost its monopoly on contracting for subsidised plantings – despite this it still carries out the vast majority of subsidised plantings.

The EU provided co-financing for hedgerows starting in 1974 with support for plantings in the west of Denmark. With the national Hedgerow Planting Act of 1976 (amended in 1988, and 1993 and 2002) support was provided for hedgerows anywhere in the country.

The objectives of the current legislation are to "provide shelter to agricultural land and/or to function as corridors […] and increase the share of small biotopes on agricultural land". These may be in the form of hedgerows (of trees and shrubs, with 75 per cent deciduous species, of 1 to 7 rows less than 10 meters wide) or small woodlots (of trees and shrubs less than 0.5 ha and less than 20 meters wide). Plantings are maintained for at least 15 years.

Currently 12 per cent of funds are allocated to individual applications with the rest going to plantings arranged through the local planting associations. Exchequer transaction costs, or administration costs, are minimal (4 to 8 per cent) as the schemes are administered by the Danish Planting Association.

Around 600 to 1,200 km of hedgerows have been planted every year under the scheme over the last 20 years - this might be compared to the longest continuous land distance in Denmark of just over 300 km. Costs per km are of the order of €3,160 (£2,110) per km over the last 5 years (GDP per capita of Denmark is about 20% greater than that of the UK).

The scheme is generally regarded as successful as the hedges are well grown and, provide both shelter and wildlife habitat. They have had a major influence on Danish agricultural landscapes. Because the schemes have a 'bottom-up' approach to developing applications and strong collaborative elements they might be held to have contributed to Danish social cohesion (social capital), as well as providing landscape features demanded by the rural population.

The Danish Planting Association is currently trialling 'collective landscape plans' in which parishes of 1,000 to 5,000 hectares, with around 100 farms, develop and implement an overall plan for agri-environmental enhancements. Thus the hedgerow schemes of the 20th century might evolve into comprehensive, coordinated, plans for ecosystem enhancements in the 21st century, with local associations providing the key motivations.

Danish agriculture generally has much more extensive experience with co-operation than is the case in the UK. The collective approach to hedge planting was perhaps a more likely to succeed in Denmark than it would have been the case in the UK. The approach has benefited from economies of scale as farmers undertake the work together. But the collective approach has not always been well developed in terms of the integration of individual plans, use of appropriate species and adaptation to local landscape character. The changes over time reflect a collective shift from the defence of agricultural production values towards a more general concern for the enhancement of the environment. And the introduction of Nature Plans (mentioned briefly in the paragraph above and in more detail in the full case study presented in Annex II) signals this change of emphasis. The objectives for the Nature Plans would seem to run parallel to the requirements for conservation initiatives and the approach seems likely to have potential. However, at this stage, it remains relatively untested in Denmark.

5.2 Land purchase in the Netherlands: Nature Policy -- Land Purchase versus Agri-environment schemes

- Marie-Jose Smits & Aris Gaaff,
- Agricultural Economics Research Institute (LEI)

This contribution describes recent nature policy in the Netherlands, in particular the relation between land purchases for nature development on the one hand and agri-environment schemes on the other hand. The focus is on the consequences of these policy instruments for the continuity of nature protection and on the available budget.

The creation of a connected area of large nature reserves, the National Ecological Network (NEN), is a core element of nature policy in the Netherlands. This is a large scale project scheduled to operate over a period of nearly 30 years from 1990 until 2018 with the ultimate aim that it should extend to cover 738,500ha (or 21.7 per cent of the land area of the Netherlands). The NEN is created by means of land purchase, both of existing nature areas and of other areas to be converted into nature areas, and by the management of land by farmers under agri-environment schemes and by other private owners. There is considerable overlap between the NEN and the Natura 2000 network, nearly all of which falls wholly or partly within the NEN.

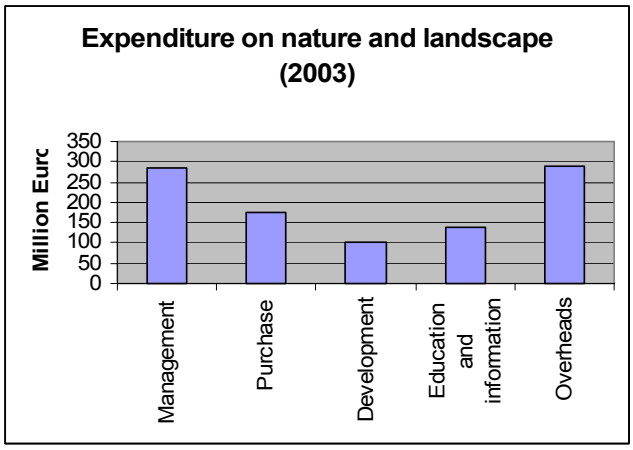
Funding towards nature policy is derived from both European and national sources. Total national government expenditure on nature and landscape in 2003 amounted to some €440 million, excluding overheads, tax facilities and research. Of this, some €48million was a transfer from the EU, primarily from the Rural Development Programme (RDP). Around 2/3rds of the total EU contribution to RDP expenditure is nature-related and of this, around

half is spent on the purchase of land[8]. Thus on average €19.5m per year was committed from the EU RDP budget to land purchase over the programming years 2000-06. The NEN budget has undergone successive changes in recent years, both upwards and downwards, as has the target for land acquisition. By the end of 2005 some 67,300 ha, around 3.5 per cent of the utilizable agricultural area, had been purchased. As of 2006, the aim for the NEN is

- 111,700 ha to be acquired by 2015 and for this to be developed for nature by 2018.
- 42,800 ha to be put under management by private owners by 2018.
- 118,700 ha to be in agri-environment schemes managed by farmers by 2018, of which 97,700 ha are located within the NEN
- 2,900 ha of wetlands purchased and 6,500 ha developed by 2010.

The overall pattern of total expenditure in the Netherlands in 2003 from all sources, including both public and private funds, EU and national and regional and tax facilities is shown in Figure 5.2.1

Figure 5.2.1: Overall expenditure on nature and landscape in the Netherlands, 2003.



Management of land for nature conservation is of three types:

- Management of purchased land by site management organisations, primarily the Dutch Society for the Preservation of Nature, Provincial Nature Conservation Societies and the State Forest Management Organisation. This can create large-scale nature areas. The main function of the land is for nature. Continuity is guaranteed. Costs total around €1,750 per ha per year.
- Management of nature areas by private owners, other than the nature management organisations or farmers. This may create either special nature area or a multifunctional nature that is not used for agriculture and must be kept in this form of management for a

[8] The legal basis for land acquisition using EU funds in the 2000-06 planning period is laid down in an Annex of the Rural Development Programme, approved by the EC (28 September 2000, adjustments approved 9 October 2001 (C(2001)2814 dd 9-1-2001),adjustments approved 13 February 2004 (C(2004) 542 dd 13-2-2004). This is under Regulation EU 1257/99 Art. 33. To comply with competition regulation, additional requirements are "- purchase takes place on a voluntary basis; - purchase takes place in consultation between state and provinces; - purchase takes place for the realisation of national objectives, in particular aimed at nature and landscape; - purchase takes place by the state agency. Following acquisition, in principle, the land is transferred to a nature conservation organisation or a public authority.

minimum of 6 years. Average cost is €1,470 per ha per year, but this is a relatively new approach and little is known about the impacts of management.

- Management of agricultural land by farmers for multifunctional nature objectives under agri-environment schemes. Minimum period of management is 6 years. Costs average €800 per ha per year.

There are thus advantages and disadvantages of land purchase and management by site management organisations and the management of land by farmers under agri environment schemes. These include the different costs for management and land purchase as well as the potential security of the environmental arrangements. Evidence available to date suggests that trends in bird species on land managed by site management organisations is generally positive, while trends on land under agri-environment schemes or in normal agricultural use are negative. Land purchase also ensures continuity of management strategies. Management aimed at restoring a rich botanical composition may be needed over a period spanning decades. In principle, nature management by site managers is in perpetuity, while farmers sign 6-year contracts in agri-environment schemes, (although 80% of present agri-environment agreement holders cultural land managers indicate that they would continue in the agri-environment scheme in the future).

Land purchase is expensive, on account of generally high land prices in the Netherlands, as is the development of the land acquired for nature areas. Furthermore, there are substantial overheads associated with running nature management organisations. By contrast, on land managed by farmers, initial expenditure is lower as there are no purchase costs. However, over the longer term expenditure is comparable. There are also fairly high transaction costs. A recent European Court of Auditors report concluded that agri-environment schemes offer insufficient guarantees of continuity and that planological protection (or protection from changes to the planning/ zoning regulations) is limited. The Court also pointed out that an operational system for measuring nature quality in relation to its objectives is lacking. (Algeme Rekenkamer, 2006 pers comm).

Political support is very important for the development of the NEN given the huge investment required. The NEN approach has support both from politicians and the general public, but there are different views as to how it should be applied. This relates particularly to the shift of funds from land purchase to management by private owners and farmers. Agri-environment schemes are less expensive in the short term and politicians have expressed a desire to broaden the involvement of farmers in nature management. A further concern too, whilst not always openly expressed, is to give farmers extra opportunities to earn money.

While figures relating to the budget for different forms of nature policy are fairly well known, figures, or values, for the consequences of continuity for effective nature protection are largely unknown. With regard to the required budgets, agri-environment schemes are least costly in the short term and thus the least expensive way of fulfilling the policy objectives of the NEN. At the same time, agri-environment schemes attract the most questions regarding continuity. While 80% of farmers have indicated their intentions to continue after the end of contract, these good intentions offer fewer solid guarantees than does the purchase of land for site management organisations.

What lessons can be learnt in the UK from the Dutch experience of land purchase versus agri-environment schemes? Land purchase is a long-term investment that needs political and public support on account of the considerable expenditure involved. In less prosperous

economic times, budgets can easily be reduced. However, land purchase has remained a major element in Dutch nature policy. While there appears to be current uncertainty as to the appropriate extent, it remains a fundamental tool. The above discussion illustrates the political difficulties of using funds for long-term acquisition, but also emphasises the importance of such acquisitions in attaining continuity of conservation benefit. It is important that long-term decisions are made in a well planned context and the NEN provides this background. Given the increasing uncertainty facing agriculture, some movement towards land purchase would seem to merit serious consideration. Once the sites have been purchased, public ownership is a strong guarantee of sustainable management, in particular for biodiversity and landscape conservation.

5.3 Conservation Reserve Program in the USA

– Ralph Heimlich, Agricultural Conservation Economics

The Conservation Reserve Program (CRP) in the USA is a very large scale scheme for taking fragile and environmentally damaged land out of production and for generating environmental benefits, for at least 10 years. It was preceded by a long history of concern with preventing erosion and supply control in the USA, stimulated by the 1930s dustbowl (widespread problems with erosion) and by the need for supply control measures (due to large surpluses depressing prices to unsustainable levels, as well as causing market volatility).

The scheme was initially established to operate on the basis of a competitive tendering process with the aim of minimising budgetary cost. However, the expected efficiency gains from competing applications were not captured as farmers rapidly learnt the maximum acceptable rent. Thus the CRP failed to fully address the problems of adverse selection through the use of a conventional tendering process. However since 1996, environmental targeting has increased the program's effectiveness. This was achieved by implementing an Environmental Benefits Index (EBI), which improves targeting of the conservation effort – allowing applications to be ranked with a multi-criteria score based largely on environmental considerations (habitats, erosion, water quality, enduring benefits, and cost). Details of the EBI are shown later in Box 1. The EBI does not, however, provide any bonuses for coordination of measures across bids, or for connecting up conservation areas into cohesive reserves - the CRP is targeted at individualistic efforts.

CRP contracts last for 10 to 15 years and around two-thirds of contracts have been re-enrolled. Thus, as long as the land is not released for cropping, the program provides for relatively long term conservation efforts. A substantial area of land has now been under various forms of contract over very long periods of time. As a result, since much land is effectively enrolled 'permanently', it may in fact have been cheaper to buy the land outright, or to secure rights in perpetuity through restrictive covenants, rather than paying farmers every year for the notional rent forgone. For example, more than 30 million acres (12 million hectares) have been in either acreage reduction programs, or CRP, since around 1985. With rental rates of around $45 per acre per year, this would suggest that the US government has expended more than $1,500 per acre ($3,700 per hectare; 5% interest rate), which is greater than the current value of US agricultural land (around $1,200 per acre, or $2,900 per hectare, on average (USDA-ERS 2005)). However, in contrast to the Dutch NEN, there is no clear

national planning framework against which specific land acquisition decisions could be taken.

A total of 14.9 million hectares (36.7 million acres), or some 8 per cent of US cropland, were approved as CRP land in total by October 2006. 7 per cent of US farm operators are 'whole-farm' enrolees in the CRP and a further 6 per cent are 'part-farm' enrolees - thus slightly more than half of enrolled farms are 'whole-farm' enrolments.

The USDA-Economic Research Service (2004) concluded in a thoroughgoing review of the program (USDA-ERS 2004) that there were few consistent economic or social effects on counties with high rates of enrolment (e.g. in counties with >17% of arable land in CRP, or with > 2.8% of total personal income coming from the CRP). The CRP, however, has extremely important supply control implications, despite some slippage (where production expands in areas outside of the CRP, due to the increase in prices caused by CRP land retirement).

The benefits in terms of erosion control have been modest, with only 17 per cent of the most erodible cropland actually enrolled. This is estimated to reduce water borne erosion by 6 per cent and wind erosion by 8 per cent. Total nitrogen and phosphorous applications in the USA are estimated to have been reduced by 5 to 6 per cent as a result of the CRP.

Wildlife is also estimated to have increased as a consequence of CRP restoring natural habitats (a major component of the EBI). More carbon is likely to be sequestered in CRP land, and chemical pollution is likely to be reduced (as a result of interception by CRP 'buffers' and reduced applications).

By valuing wildlife, supply control savings, and soil productivity (amongst others) the CRP is shown, in Heimlich's case study (Annex IV), to have a net social benefit of around $12 billion between 1985 and 2005 (or around $800 million per year). A summary of the costs and benefits is shown in Table 5.3.1

Table 5.3.1: Summary of the costs and benefits of the CRP, 1985-2005

	1985-2005	
	Million dollars, undiscounted average per year	**Million dollars, NPV at 3% discount rate**
Direct costs (rent, incentives, establishment cost, technical assistance and administration)	$1,520	$21,799
Supply control savings	$783	$11,052
Net cost to the government (a)	$736	$10,747
Soil productivity	$202	$3,003
Water quality	$543	$8,078
Wind-blown dust	$96	$1,427
Wildlife habitat	$704	$10,474
Partial natural resources subtotal (b)	$1,545	$22,982
Net social benefit (b) – (a)	$809	$12,235
Source: Agricultural Conservation Economics.		

Some of the major challenges in the CRP are seen to be:

- Targeting the most valuable environmental prescriptions;
- Setting rental rates to be sufficiently attractive without overpaying; and
- Slippage (CRP land retirement inducing more land elsewhere to be brought into cropping).

The maximum acceptable rental rate is set on the basis of county average rentals and so this is, in effect, a fixed price scheme. But choosing at what level to pay is a major problem for the scheme administrators. As there is variation in farm costs around the mean rental, if the mean rate is paid approximately half will not receive sufficient incentive to participate and half will be overcompensated (in a world of rational agents). On the other hand if much more than the mean rental rate is paid most will be overcompensated. However, it is possible for applicants to offer their land at below this average rental rate, giving them extra points under the EBI scoring system and so increasing their chances of being accepted. This thus retains an element of price competitiveness in the absence of the full tendering approach.

Peaks in maize and wheat prices in late 2006 resulted in pressure on the administration to reduce the acreage of the CRP and thus reduce pressure on grain prices for biofuels and animal feed. However, early proposals for the 2007 farm bill suggest the CRP acreage will be maintained at current (2007) levels, mainly for its' environmental benefits.

The CRP represents a very large scale scheme that has now been in operation for over twenty years. The initial emphasis was on supply control and on protecting the production potential of fragile agricultural land. However, over time the emphasis has shifted towards a wider range of public goods, similar to the experience with simple types of schemes in other countries. The initial implementation of a full tendering approach offers useful lessons for its adoption elsewhere, questioning whether it would be useful. But the subsequent development of the Environmental Benefits Index does suggest a potentially valuable mechanism. It is noted that land purchase might have been cheaper than holding land in rental contracts, but in the long term, there are no obvious mechanisms within the CRP under which land could be targeted for the acquisition of permanent rights. Significant areas of land are acquired for conservation purposes in the USA, especially by Land Trusts. Land Trusts are non-profit organisations that act to conserve land by means of land or conservation easement acquisition and stewardship or by land ownership. There are some 1,600 Trusts in the USA which have protected over 37 million acres (15 million ha) of land in the USA. This represents a separate operation from agri-environment schemes. The CRP has perhaps uniquely been the subject of substantial research and evaluation. The results summarised here indicated the very large net social benefits that are assessed to have been generated by the scheme.

Box 1: CRP Environmental Benefits Index

Offers for the Conservation Reserve Programme are ranked by the USDA Farm Services Agency (FSA) according to an Environmental Benefits Index (EBI)[9]. FSA collects data for each of the EBI factors. For sign-up number 33 in March-April 2006, the following factors were included:

- **N1 Wildlife habitat benefits resulting from covers on contract acreage;**
  Point score 0 to 100
  Cover practice planting mixtures are assigned points based on the potential value to wildlife within each state. Native mixes of diverse species generally receive the highest point scores. Examples include: permanent introduced grasses and legumes; establishment of permanent native grasses and legumes; tree planting; permanent wildlife habitat corridors; rare and declining habitat restoration.
- **N2 Water quality benefits from reduced erosion, runoff, and leaching;**
  Point score 0 to 100
  An evaluation of the potential benefits that CRP may have on both surface and groundwater quality. It is comprised of three subfactors: Whether in a zone identified water quality protection; Groundwater quality, based on predominant soils etc; and Surface water quality, based on amount of sediment delivered to streams and human population affected.
- **N3 On-farm benefits from reduced erosion;**
  Point score 0 to 100
  Help maintain the long-term productivity of the land for future generations, based on erodability potential of land
- **N4 Benefits that will likely endure beyond the contract period;**
  Point score 0 to 50
  The likelihood that practices will remain in place beyond the CRP contract period, based on type of conservation practice, primarily for tree planting.
- **N5 Air quality benefits from reduced wind erosion;**
  Point score 0 to 45
  Evaluation of air quality improvements from reducing airborne dust and particulate from cropland. In addition points included for value of carbon sequestration.
- **N6 Cost.**
  Point score Cost (point value determined after end of sign up based on actual offer data + cost share (0 to 10 points) + offer less than maximum payment (0 to 15 points)
  An evaluation of the costs of environmental benefits per dollar expended.

After the sign-up ends, the FSA determines the EBI thresholds that it will use to offer acceptance. EBI cut off is determined after analysing and ranking all eligible offers. As CRP is a highly competitive program, producers who would have met previous sign-up EBI cut-offs are not guaranteed a contract in the current sign up.

Producers are urged to make their offers more competitive by

- using cover practices that attract a high score,
- only offering most environmentally sensitive land,
- enhancing covers for the benefit of wildlife,
- accepting a lower payment rate that the amount FSA is willing to offer.
-

The EBI is set out in:
http://www.fsa.usda.gov/FSA/newsReleases?area=newsroom&subject=landing&topic=pfs&newstype=prfactsheet&type=detail&item=pf_20060401_consv_en_crp33ebi0.html

5.4 Auctions for agri-environment public goods in Australia

- Uwe Latacz-Lohmann, University of Kiel and University of Western Australia

There is currently a widely held expectation that tendering mechanisms should be more efficient in economic terms than traditional fixed-price payments for purchasing environmental goods. This stems from the theoretical advantages of competitive mechanisms for service provision. Namely:

- Budgetary cost-effectiveness so that more environmental benefit can be purchased for a given outlay;
- Economic cost-effectiveness by allocating bids to the most efficient service providers;
- Price discovery revealing landowners true costs of service provision; and
- Fairness from a transparent process and avoiding the need to calculate an income foregone and to set a pre-determined level of payment.

This study reviews the experience of two pilot auction schemes in Australia: "Bush Tender" in the state of Victoria and "Auction for Landscape Recovery" in Western Australia and comments on some experimental work on the way in which auctions schemes may operate.

There has been recent interest in the use of agri-environment schemes in order to promote the provision of ecosystem services. "Bush Tender" was trialled in 2001 and 2002-03 in two regions of Victoria with a total budget of A$1.2 million. After initial publicity, landholders were visited by a field officer. They identified the potential actions and agreed a management plan. Landholders competitively tendered for contracts to enhance the native vegetation on their farms based on the management plan and a bid for payment to carry out the proposed actions. Bids were assessed against a Biodiversity Benefits Index, and contracts were allocated, resulting in a total contracted area of 4,844 ha, from 106 out a total of 149 bids. The mean costs per ha under contract was A$248/ha. Authors of an assessment of the scheme estimated that, assuming a constant budget, the increased quantity of biodiversity contracted under a competitive scheme would be of the order of 25 to 30 per cent more than that under a fixed price scheme. Alternatively it was estimated that it would have cost between 6.5 to 2.6 times as much to have attained the same level of biodiversity benefit under a fixed price scheme.

"Auction for Landscape Recovery" (ALR) was trialled in one catchment in Western Australia in 2004-05, again in two rounds. The approach was similar to that in Victoria but it targeted multiple benefits from land management improvements, including biodiversity, salinity control and groundwater recharge abatement. Landholders could put in more than one bid

and were encouraged to put in joint bids for sites that offered synergistic conservation value. Considerable emphasis was given to communication with the target group and an active role was played by Community Support Officers. A total of 88 bids were received and, with a budget of A$200,000, 23 bids were successful. Analysis suggested that cost-effectiveness of the scheme compared to that of a uniform price scheme varied between 315% and 207% in round 1 and 165% and 186% in round 2, depending on the assumptions made. Overall there was no evidence that the ALR imposed higher administrative costs than equivalent fixed price schemes.

Both schemes operated on the basis of payment for inputs (or management activities) rather than outputs, such as biodiversity increases or reduced salinity. Both assessed environmental benefits on the basis of a benefits index that included the range of benefits sought from the schemes, which in the case of ALR included a wider range of benefits and a component for synergistic benefits from cooperation between adjacent farms. It was found to be difficult to clarify and make explicit the relative weighting of different ecological benefits, which farmers would need to know if they are to optimise their conservation activities. These may even not be clear to the scientists themselves where a complex computational process is adopted. Subjectivity is inevitable in this process. Some farmers tendered at below their opportunity cost, and follow-up interviews suggested that some would have carried out the works even without payment.

While the initial analysis of the schemes has suggested major costs savings from the competitive approach, this may be misleading. The true cost effectiveness of these tendering schemes is in fact difficult to calculate as the farmers' actual supply curves, or true opportunity costs, remain impossible to derive. Caution is thus required in interpreting the outcomes.

Experiments were conducted with students at the Universities of Kiel and Western Australia. Participants were offered hypothetical contracts to reduce leaching and run off from nitrogen fertiliser. The results indicated that an auction outperformed fixed-price alternatives in the first round, although to a lesser extent that was implied in the Australian case studies. Further repetition of the process erodes the gains from the auction format, such that the gains were lost by round 3.

Experimental games and the two rounds in each of BushTender and ALR suggest that the main efficiency gains occur only in the first rounds, as participants learn to shade their bids - thus cancelling any price benefits from competition (as was the experience with the USA's Conservation Reserve Program). This disadvantage might be offset by varying aspects of the contract, such as the budget or target level of environmental benefits, so that the maximum acceptable price varies between rounds. The dissemination of information, through involvement of community leaders and professional advisers and advertising, was also seen as critical to the success of competitive schemes.

This case study sounds a note of caution against adopting a fully competitive auction process. There do seem to be some potential benefits in the early stages, but less than has been anticipated. This is coupled with the complexity of the procedure that could involve a significant risk of failure. Coupled with the experience with tendering under the Conservation Reserve Program, this suggests that further research, including laboratory based work, would be desirable before there was any move into practical implementation.

5.5 Other innovations: Environmental co-ops and landscape purchase and payments

Environmental Co-operatives: Netherlands

Co-operation has been a characteristic of farming systems in many countries. Small farmers have attained some degree of economies of size by working together, perhaps buying their inputs together or sharing machinery. The extent of cooperation amongst farmers has varied considerably across different countries. In Denmark, for example, cooperation has included a majority of farmers but the co-operative movement has been less successful in Britain, perhaps because of the relatively larger average size of farm, or because the emphasis has been more on increasing the size of individual businesses or perhaps for cultural reasons.

Renting and Ploeg (2001, p87) discuss the development of environmental co-operatives in the Netherlands. They describe environmental co-operatives as 'innovative associations of farmers based at local or regional level, which promote and organize activities related to sustainable agriculture and rural development in their locale'. This introduces a more formal organisational structure that offers members the opportunity to participate in activities related to sustainable agriculture and rural development. The authors estimated that there are around 100 such co-operatives, with over 6,500 members representing around 6% of Dutch farms in 1999. The farms are above average size and predominantly grassland. The co-operatives have been pioneers in experimenting with new environmental codes and rules, such as nature management plans, mineral balances, ecological norms, codes of conduct and farm certification. The co-operatives have stimulated the development of organic farming and farmer participation in environmental schemes.

As a consequence they have generated general improvements in local environmental quality and opened up possibilities for further developments, such as for agro-tourism. Renting and Ploeg argue that these initiatives shifted the locus of control of farming and rural development back to locally specific coordination mechanisms. Clearly this has been something of a sticking point for the national government. The co-operatives that were first established were given exemptions from national environmental regulations on the basis that they could establish their own, localised regulatory frameworks on an experimental basis. While there was initial enthusiasm for this approach, the Dutch Ministry of Agriculture, Nature Management and Fisheries has not been willing to extend the flexible approach and it has made it clear that these exemptions will not be extended to other co-operatives. While this lack of national institutional support for the approach is seen as a setback, it is argued that the general direction being developed is in line with general tendencies in international and European policies such that the approach is likely to be extended even in the absence of Ministry support.

Theoretical benefits arise from groups which can plan at the level of landscapes, rather than individual farms (Franks and McGloin, 2006). That is, the spatial scale at which co-operatives can operate is more appropriate for addressing ecological issues. Information asymmetry, between the buyer of environmental goods (the government) and the suppliers (farmers), is reduced because members of a co-op are likely to have a much better idea of what their neighbours are supplying, and can supply, than government officials. Better information held by co-op members, unlike government officials, is also likely to reduce moral hazard (or the temptation not to deliver on costly environmental commitments)

provided there is a strong incentive to deliver measurable benefits overall. The risk of failure to deliver is lessened because farmers, if they do less than necessary, are likely to be identified and upbraided by their neighbours. Other benefits include co-operatives motivating a greater stewardship ethic (affecting social norms), and farmers' participation in the design of solutions to environmental problems. Also, environmental co-operatives are local organisations with the objective of providing environmental benefits in a defined area, which covers many farms. Thus they provide a sound vehicle for environmental action by linking farmers at the landscape scale with agri-environmental objectives, and appropriate incentives. By linking people to achieve common objectives, and networking, co-operatives contribute to social cohesion, and thus build social capital.

Co-operative members can provide direction to the co-op and suggest innovative solutions - the co-op becomes a vehicle for communicating solutions to problems through networking. Also provides links between the government and groups of people who are responsible for management of the agri-environment.

At the same time co-operative solutions can also involve problems (Franks and McGloin 2006):

- how much environmental goods to provide (as the goods are not priced in a market, the optimal level of provision is difficult to decide);
- level of payments (income forgone, or opportunity cost, incentive payments, etc);
- lack of trust, and sharing of information, can lessen the amount of effort members put in;
- transaction costs and enforcement;
- difficulty in designing an effective legal and administrative structure (incentives and sanctions);
- securing the benefits in the long term (enduring benefits).

Franks and McGloin (2006) estimate that 10 per cent of Dutch farmers were enrolled by 2006 in some form of environmental co-operative. Participation rates are highest amongst large dairy farmers, which may reflect the threat of regulation and early exemptions from regulation granted to co-operative members. In Japan almost all Less favoured Area payments are made to *shuraku* (the smallest autonomous group in a village) and only a tiny minority are paid directly to individuals - the *shuraku* decide how best the LFA payments should be spent or distributed to members (Shigeto and Hubbard 2004).

Farmers will join co-operatives where they see clear benefits (e.g. access to agri-environment payments) and reduced burdens from membership. Co-operatives can be successful in the global markets, as illustrated by the big Nordic agricultural co-operatives and the very large national dairy co-ops in New Zealand. If the government provides incentives and sanctions, for example by paying for environmental goods at the scale of Drainage Boards, Natural Areas or catchments, co-operatives can develop to distribute both the benefits and burden - as illustrated by Dutch environmental co-operatives (Franks and McGloin, 2006).

As environmental co-operatives move beyond being simply conventional farm groupings to involving stakeholders beyond farmers, they become quite similar to the Landcare Groups that developed subsequent to the founding of the Landcare movement in Victoria in 1986. The emphasis thus shifts from groups of farmers with a common, primarily commercial interest, towards one of seeking to engage a much wider community of stakeholders with more general responses to environmental challenges. Much has been written on the

Australian Landcare movement (see, e.g. Curtis, *et al.* 2002; Wilson, 2004; Youl, *et al*., 2006).

5.6 Private landscape protection in Austria

A second topic on which we sought a case study was the use of local taxes for the protection of landscape in Austria. A short report on this is given by Pruckner (2005). In this case, tourists and the local community in the Weißensee area of Austria make payments to farmers who keep to specific landscape management guidelines. The scheme is administered by a private 'Landscape Conservation Organisation' (LCO). This organisation has set out comprehensive production and landscape guidelines to be followed by farmers in return for monetary payments. Payments are funded from a tourist fee of €1.38 (peak season) or €1.16 (off season) per person per night imposed on visitors and a proportion of this fee (€0.073 per night per adult) is transferred to the LCO. The scheme is relatively small both in terms of total scale and in the amounts paid per farmer. There were only 26 farmers in the programme and in 2001 the total amount of the fee transferred from fees was around €25,500, to which €18,100 was added from the community budget. It is not clear whether the approach is being used elsewhere. There are also examples of this type of approach in the Lake District where contributions of a proportion of booking fees taken by tourism operators or of takings in outdoor equipment shops are contributed towards the management of parts of the National Park. The approach raises a variety of questions as a potential approach towards the payment for the conservation of landscape, but it has not been possible to pursue them further.

Implications of the case studies

The provision of public goods from agri-environment schemes is often enhanced by the co-ordination of actions across a landscape scale; that is a scale that is generally in excess of the areas of land controlled by individual landholders. This may allow the attainment of economies of scale, such as in water level management or administration, as well as providing linkages and networks of habitats critical for certain species. This implies some sort of institutional arrangement by which this co-ordination may be facilitated - possibly through national planning frameworks. The case studies have provided illustrations of how the co-ordination issue has been addressed in the hedge planting associations in Denmark and the environmental co-operatives in the Netherlands. It would appear that collective schemes have potential in the UK, with appropriate incentives, sanctions and institutions (as detailed recently by Mills *et al* (2006)). It is likely to be worth testing collective schemes at the level of drainage boards or catchments.

Experience in these countries also illustrates approaches towards the planning of environmental changes. This is reflected in the Danish exploration of collective nature plans. The Dutch experience seems more advanced with the development of the National Ecological Network. The long term security of land management for the development of ecological values was identified as a key issue by the Dutch case study. This is resolved in the Netherlands through land purchase, although the US case study also makes reference to the use of conservation easements. Permanent easements (or covenants), as used by NGO groups in the USA, such as Ducks Unlimited, have the potential to secure environmental benefits for the long term. They have an advantage in achieving long term security in that they are cheaper than land purchase. Also, it is clearly critical that detailed planning precedes land

purchase so that available funds are targeted at the most suitable areas of land. While there are elements of both of these approaches in the UK, it is not clear that they have been drawn together in a systematic way or that funds have been used from agri-environment sources to achieve long term security of conservation benefits.

There has been extensive discussion in the past as to whether a greater element of competition might be introduced into agri-environment schemes in order to ensure that expenditure is used more cost-effectively. The case studies from the USA and Australia both provide guidance on this issue. The Conservation Reserve Program (CRP) was initially based on a process of competitive tendering, but this did not work well (because farmers learnt the maximum acceptable rental rate over the first few rounds of the scheme, and did not tender below that). The experiments with tenders in Australia appear to have generated some cost savings, although perhaps not as much as has been claimed in some of the evaluations. There are also doubts as to whether the savings can be sustained across subsequent rounds of the tendering process. Both case studies suggest a need for caution in the introduction of tendering. Both schemes use an environmental benefits index as a method of ranking applications - in the case of the CRP this is undertaken at a very large scale on the basis of standard data. Such indexes may have relevance for the further development of UK entry level schemes.

6. Payments for the provision of public goods

As has already been explained, agri-environment policy arises primarily because the benefits sought are not readily provided through markets. Thus government effectively purchases the countryside goods on behalf of the general public. The implication of the market analogy suggests that the approach adopted by government should seek to emulate the characteristics of an 'efficient' market.

In such a market there would be interactions between supply and demand to generate an observed price for a defined commodity. This price signals the consumers' willingness to pay (WTP) and prompts producers to organise the resources needed to bring the supply to the market. Competition between producers tends to depress the market price so that only the most cost-effective producers will be successful in making a profit. These producers will face the incentive of higher profits to organise their production and to adopt innovations that can drive down their costs of production and / or to raise the quality of the product so as to be able to attract a higher prices from the consumer. It should be noted that this assumes that farmers supplying countryside goods are profit maximisers.

In place of a market in environmental goods, government offers payments to farmers in order to encourage them to provide the sort of goods that are determined to be required as part of the political process. But in the absence of a true market there is no actual price either against which to assess the values placed on the outputs by consumers or to determine what price should be offered in order to stimulate the supply. In the absence of price, governments have generally set the level of price to be offered in terms of the income foregone by the farmer in changing the farming system so as to be able to deliver the required environmental improvement. As argued in CRER (2002) this should be regarded more generally as an opportunity cost. The volume of supply tends then to be determined by the numbers of land managers taking up the options on offer, such as in the Entry Level Scheme, or against the budget made available to fund the scheme, such as in the Countryside Stewardship Scheme in England, or the Rural Stewardship Scheme in Scotland.

This process is associated with various information problems. A critical problem is one of asymmetric information; that the government has less information about the farming system than does the farmer. Government does not know what is the cost facing individual farmers of undertaking the required actions and therefore offers what is estimated to be an average cost. In practice, of course, there is a wide range of costs experience across different farms. Because participation in the scheme is voluntary only those farmers whose actual cost is less that the payment offered will be likely to enter the scheme and this means that there will inevitably be some element of producer surplus gained by farmers, enjoyed by all those producers who can undertake the required changes at less than the average cost. This represents a transfer payment from the taxpayer to the farmer. The problem is referred to as one of adverse selection. Producers can often also gain an element of producer surplus in markets too, but in markets the competitive process will tend to encourage low cost producers to expand their supply and to drive down price so as to reduce its level. Generally the wider the range of costs across the farm population, the greater will be the value of the producer surplus gained by entrants to the scheme; there will be a greater level of variation from the average cost. Two approaches have been suggested in order to reduce this level of transfer payment. One is to divide the designated area into smaller units within which landholders are

relatively homogeneous and thus face similar costs. The price paid for entry into the scheme can then be varied between these smaller units. The second way in which the levels of transfer payment may be reduced is to admit landholders to the scheme on a competitive basis whereby they would have to tender for participation. Given effective competition, the government agency would in principle be able to reduce the levels of transfer payments and thus reduce the exchequer costs of the scheme. Practical experience with this approach was explored in the case studies from the USA and Australia.

A second type of asymmetric information problem relates to the position after the contract has been let and it arises because the government agency cannot accurately observe the exact nature of the actions taken by each individual farmer. Assuming that compliance with the contract incurs some costs, then farmers have a direct incentive not to adopt the actions required in the contract and the asymmetric information means that the chances of being caught are relatively low. In this case, the problem may be addressed by monitoring and the application of penalties on farmers found not to be complying. A relatively high penalty imposed on those contractors who cheat can act as a deterrent.

Payment by results

The implication of this discussion is that schemes that adopt approaches that are closer to market principles will tend to be more efficient. Thus, in principle, it would be preferable to pay farmers on the basis of the environmental outputs delivered rather than in terms of compensation for changes made to land management. The issue was explored in some detail in CRER (2002). A payment-by-results strategy would in theory have a number of advantages over the current system:

- It would create strong incentives to produce high-quality environmental goods and to develop innovative approaches to environmental management. Farmers would be able to apply their superior knowledge in determining the methods used to supply the public goods on their particular holdings. There would be no need for separate payments for operational and capital items.
- Payment by results would create incentives for co-operation among farmers across several holding where this could enhance efficiency. We discuss collective issues further in the context of the case studies and subsequent discussion.
- A result-based payment scheme may reduce the need for compliance monitoring. Rather than monitoring farmers' actions, the environmental agency would just need to check whether certain output had been produced.

However, there are also significant difficulties:

- There is often a substantial delay, potentially of several years, between the adoption of changes in land management and the production of the environmental outputs. Farmers would require some extra financial incentive to compensate for the period before the return is received.
- The relationship between changes in land management and the delivery of environmental outputs can be very uncertain, often depending on factors outside of the land managers control.
- Farmers are generally risk-averse (though not always) and so for this reason too would demand higher payment rates for the same level of uptake. We may note

against this, that the government, operating a large number of contracts may effectively be indifferent to risk and so it could be less costly (and more efficient) for government rather than individual farmers to take on this risk.

- There is often no consensus over what counts as an acceptable environmental output or outcome. Even ecologists tend to disagree on this question in many cases, such as in the botanical composition of grassland.
- It may be difficult (and costly) to determine, measure and quantify environmental outputs to a standard that would satisfy the requirements of an enforceable, written contract. The output may not be readily observable at all times, such as a number of birds feeding on a particular area of land, and may anyway vary at different times of day or year. It may thus be difficult to replicate the determination of output levels and so raises the likelihood of complaints and appeals by farmers who feel that they have been treated unfairly.

There have been various proposals and experiments for schemes based on environmental outputs. As with any environmental incentive policy, it is necessary in practice to identify some indicator representing environmental outputs against which the incentive may be set. An early attempt goes back to an Integrated Rural Development experiment in the Peak District in the late 1970s where payments were made to farmers on the basis of the numbers of wildflower species recorded in farmers' pastures. Gerowitt, *et al.* (2003) has reviewed the context for a market for ecological goods and Rüffer (2004) has described a planned results-oriented payment scheme in Lower Saxony where farmers will receive payments for providing identified target species in grassland. Results will be defined against control areas identified by the farmers themselves that can be checked by the administrating authority. When the control shows that the ecological good has been produced, then the farmer receives payment according to his bid in an initial auction. If the environmental output is not demonstrated, then no payment is made. At this stage, we have not seen any results from this experimental scheme. However, it would be helpful to draw together the experience that has been gained from experimental schemes where such payments have been applied.

The general conclusion is that payment-by-results schemes may represent a realistic alternative to current payment systems in those cases where there is a relatively close link between actions and environmental outputs and where outcomes can be measured with relative reliability, confidence and at reasonable cost. For example, numbers of nesting birds or the conservation of wildflower meadows may be cases in point. This could improve the incentive structure available to farmers in agri-environment schemes but more work is required to develop appropriate indicators and institutional frameworks within which such payments are made.

There may be some intermediate options where some element of the payment is linked to environmental outputs. It could be possible to link a proportion of the payment to the required changes in management and then to pay a further element in respect of the provision of the environmental output. In England, the Higher Level Scheme component of Environmental Stewardship does identify some indicators of success. These are agreed between the landholder and the Natural England advisor and are intended to 'paint a picture' so that the landholder and advisor can judge whether the management is working, and to see whether adjustments are needed. They can form the basis for any necessary fine tuning of the land management approach in order to allow for variations in conditions between years and between different areas of land. In principle some proportion of the payment might be conditional on the attainment of these indicators.

The calculation of income foregone

Under the current EU Rural Development Regulation (1698/05), agri-environment payments continue to be linked to income foregone (this principle is also enshrined in the WTO Green Box). The principle of determining payment rates on the basis of income foregone was established in circumstances when agricultural output prices were substantially supported by agricultural policy and investment in agricultural intensification was profitable. Given the assumption that land holders held the right to take such action, it was appropriate to offer payment equal to the income foregone. Under EC Regulation 1257/99, payment also included an amount in respect of additional costs resulting from the commitment given and the need to provide an incentive. This is modified slightly in Regulation 1698/2005 where it is indicated that payment shall cover additional costs and income foregone, and, where necessary, transaction cost. A possible problem would seem to arise where the agricultural activity is not profitable and the role of agri-environment scheme is to retain the agricultural activity in place. This would seem to be closer to the position represented in paragraph 37 of Regulation 1698/2005, where it is stated that "Support should be granted for non-remunerative investments where they are necessary to achieve commitments undertaken under agri-environmental schemes or other agri-environmental objectives".

It should be recognised that sometimes payments are made to discourage profitable agricultural production activity i.e. to reduce the intensity of production, and sometimes payments are made to promote agricultural production activities that are otherwise not profitable. The position is illustrated in Figure 6.1 (Hodge, 2006).

Figure 6.1: Alternative arrangements for the support of non-commodity outputs.

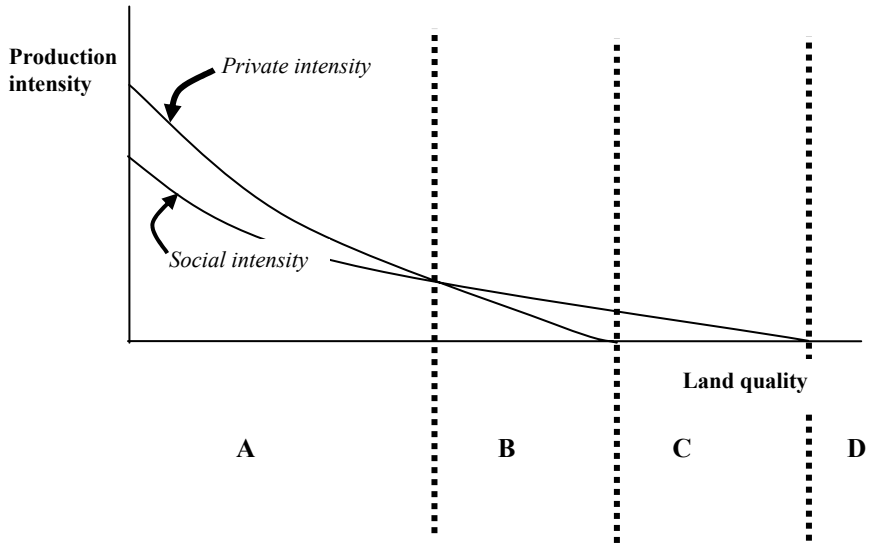


Figure 6.1 relates agricultural production intensity to levels of land quality across the horizontal axis, with high quality land for agricultural production on the left declining across to the right of the figure. It defines two types of 'optimal' uses, a 'private intensity', the counterfactual position, that maximises the returns to private landholders, and a 'social

intensity' that maximises the net social benefit associated with the use of land of a particular quality. In this context, 'private' represents the production incentives facing the farmer, including any commodity price support and partially decoupled payments, other than agri-environment schemes. It is assumed that more productive land is used more intensively for agricultural production and that this higher intensity is associated with lower levels of environmental quality. At the other extreme, lower quality land may not be well managed or may not be used profitably at all from a private perspective. The figure indicates four possible relationships, as explained in Table 6.1.

Table 6.1: Alternative land management arrangements to attain a social optimum

	Requirements for a social optimum
Zone A	Private intensity exceeds social intensity. This assumes that the private intensity is consistent with the reference level of property rights (*i.e.* what one is allowed to do subject to regulation). Policy would seek to reduce agricultural production intensity at the intensive margin. Example: payments for the provision of buffer strips in arable areas.
Zone B	Social intensity exceeds private intensity. Policy would provide incentive payments to increase the level of production intensity at the intensive margin. Example: payments in upland areas to maintain sufficient grazing to prevent growth of scrub or to maintain heather.
Zone C	Social intensity would continue production in areas that are not profitable in the counterfactual position. This thus seeks to shift the extensive margin outwards. Example: payments to prevent land abandonment.
Zone D	No land uses are beneficial, from either a private or a social perspective.

The aim of agri-environment schemes may be seen simply as being to move production from the private intensity to the social intensity. In some cases this involves payments to farmers to reduce the intensity of production, such as by leaving areas of arable land uncropped or by reducing stocking rates on grassland. But in other circumstances, the objective is to promote production activities where they would otherwise not be undertaken. This may be seen, for instance, as the purpose of the Less Favoured Area Scheme, which although also part of RDP Axis 2 is quite separate from the agri-environment schemes it funds. When agri-environment schemes were initially introduced in the mid-1980s, it was in the context of relatively high levels of coupled agricultural support and the agri-environment schemes were generally acting against this to reduce incentives to produce. However, with lower levels of commodity prices and the decoupling of support payments, the emphasis shifts towards payments that are seeking to promote activities that would otherwise be unprofitable to farmers at the margin.

The implication of the change for the definition of income foregone may simply be a semantic issue rather than one of substance. If the counterfactual position is not privately profitable in the first place, as is the case in Zone C, then logically, there is no 'income' to be 'foregone'. However, it may be assumed that the resources required to keep the land in

agricultural production, especially the labour, do have an opportunity cost in some other use and it is this opportunity cost that represents what must be foregone in introducing the agri-environment scheme. An alternative way of viewing the issue might be in terms of the analogy with public sector procurement more generally where payment might be defined in terms of the minimum level of payment that would be required in order to secure the provision of the required output. While this would generally be tested through a process of competitive tendering, we can view the costs of provision in terms of the costs faced by potential suppliers in meeting the requirements of the contract.

It may not matter whether or not the payment is framed in terms of an 'income foregone', provided that it is recognised as representing the opportunity cost of the resources used to produce the desired environmental outputs. Whether or not the resources committed to an agri-environment scheme have some profitable use in farming, it may usually be assumed that they do have some sort of opportunity cost in some use or other. Thus labour devoted to loss-making farming systems could be reallocated to remunerative activities outside the agricultural sector.

Partial or whole farm accounting?

A more pertinent issue is how payments should be determined when the whole farming system is unprofitable. In this context, the partial budgeting approach taken in the determination of agri-environment payments may not be sufficient to maintain the activity required. Agri-environment payments are currently calculated on the basis of the incremental impact of the changes associated with the requirements of entry into an agri-environment scheme on farm income. This takes account of any extra income or lost income in terms of gross margins, and any costs saved or extra costs of specific operations. Account is also taken of changes in interest on working capital. This is then used to calculate the change in income, assuming that fixed costs are unchanged.

Incomes on farms are often relatively low, with the implication that the survival of the business as a whole may be at risk. Where this is the case the incremental compensation payments on offer in agri-environment schemes may not be sufficient to ensure that the farming activity necessary to conserve the environment is maintained e.g. retention of the beef farming enterprises necessary to maintain species rich marshy grasslands in optimum condition. The decoupling of farm subsidies and pressures to eliminate the remaining market supports (intervention, export subsidies, tariff barriers etc) will further reduce the income that derives from agricultural activities unless farmers are able to add value to basic commodities in some way such as through product differentiation or co-operative marketing.

Table 6.2: Alternative measures of farm income in England, 2005/06

£/farm 2005/06	Net Farm Income	Occupier's net income	Cash income	Family farm income
Dairy	27,100	26,500	46,400	36,600
Grazing Livestock (Less Favoured Area)	11,800	12,900	25,000	15,500
Grazing Livestock (Lowland)	5,300	6,800	19,300	9,500
Cereals	14,100	24,100	51,100	32,900
General Cropping	26,700	31,500	60,300	37,300
Specialist Pigs	29,000	25,900	55,800	30,200
Specialist Poultry	97,500	91,400	115,300	93,200
Mixed	17,400	19,600	45,000	33,300
Horticulture	32,700	31,000	51,200	34,900
All Types	21,100	23,900	45,300	30,900

Source: Defra. Farm Accounts in England 2005/06
http://statistics.defra.gov.uk/esg/publications/fab/2006/excel.asp

Farm incomes can be measured and expressed in a variety of ways, depending on the objective at hand, as explained recently by Defra (2006). As is evident from Table 6.2, the use of different measures can create quite different impressions of the level of income generated by a farm business, and hence the probability of its survival.

Following the logic of decoupling, it might be assumed that the agricultural activity will only be continued where it makes a positive contribution to overall farm income. However, it is quite common for the agricultural activities on a farm as a whole to be unprofitable. Table 6.3 presents recent average results from the Farm Business Survey for grazing livestock farms (within Less favoured Areas) and cereals farms (largely outside LFA).

Table 6.3: Average Output and Input Costs by Farm Type, 2005/06 (based on Farm Accounts in England†; GBP).

	Grazing Livestock (Less Favoured Areas)	Cereals
Agricultural output	**32,547**	**112,388**
of which:		
Crop Output	**1,642**	**91,195**
- winter wheat	125	45,120
- oilseed rape	0	14,556
- by-products, forage & cultivations	1,315	6,917
Livestock Output	**28,364**	**10,590**
- other cattle	13,350	5,187
- sheep and wool	15,910	2,807
Agricultural costs	**46,925**	**142,050**
of which:		
Variable costs	**19,540**	**57,895**
- fertilizers	1,988	14,369
- crop protection	185	16,951
Fixed costs	**27,475**	**84,155**
- machinery costs	10,591	31,255
- general farming costs	6,915	18,695
- land and property costs	7,077	17,411
Ag. Output Less Ag. Costs	**-14,377**	**-29,663**
per cent of Agricultural Output	-44%	-26%
Other Output:	**31,777**	**62,879**
of which:		
Output from agri-environment, HFA, etc	9,819	4,685
Output from diversification (not agric.)	4,036	15,945
Single Farm Payment	17,922	42,249
Number of farms in sample	234	339

†Derived from Farm Accounts in England 2005/6 (Defra)
http://statistics.defra.gov.uk/esg/publications/fab/2006/excel.asp

The figures indicate that while there is an overall positive net income, the agricultural activity on its own makes a substantial loss, even for an average farm. The net loss from agricultural operations was a much greater proportion of Agricultural Output in LFA Livestock farms

(-44 per cent) compared to Cereals farms (-26 per cent). Some of the other output, such as from agri-environment schemes may be dependent on the continuation of agricultural activity, (for example the SPS is dependent on a minimal level of activity in order to meet demands of GAEC). Given the higher proportionate loss in the LFA, we may assume that land abandonment is much more likely to occur in the LFAs.

Of course, the data presented in table 6.3 covers only one year. In fact, cereal prices rose from around £64 per tonne in October 2005 to around £91 per tonne in October 2006 (ex-farm, *HGCA* (the, levy funded, marketing and research organisation for cereals in the UK)) - a rise of 42 per cent. Prices of other grains, such as oilseed rape, rose similarly. Thus one might estimate that, with a 30-40 per cent rise in grain prices, the gross output from cropping on cereals farms would have risen by a similar proportion - around £32,000. This could mean that, in the 2006 harvest year, cereals farms made a small profit on agricultural operations. However the rise in output prices will have been offset, to some extent, by increases in fuel and fertilizer costs in 2006. Sheep prices, by contrast, have been relatively unchanged in 2006 compared to 2005 while beef prices have increased by a small amount (perhaps 10 per cent) in that time. Thus at the time of writing it would appear that the economics of cereal cropping are likely to be better in 2006 than in 2005, whereas LFA livestock farms probably continue to make significant losses in 2006. Although in the strict economic sense farmers are making a loss, the SPS makes it evident that such farms are actually working hard to convert their subsidies into less money. This has been the case for many years, but the situation was masked by the initial use of market supports and then by use of direct payments.

However, it might be argued that a rational agricultural producer would not continue with production under these conditions, in that the net income would seem likely to be higher if agricultural production was stopped. Whether or not is makes sense for the land to be kept in agricultural production, by the present or an alternative farmer under the circumstances described in Table 6.3 for 2005/06 is uncertain. The two alternatives are that production stops but the land is kept in Good Agricultural and Environmental Condition so that it retains entitlement to the Single Farm Payment, or that it is abandoned altogether. The immediate implication of the negative return to production is that production would stop. However, even though the agricultural costs exceed the agricultural income, income from 'other output' is also dependent on the approach to land management. In the short term, while fixed costs cannot be avoided, the positive farm gross margin (Agricultural output less variable costs) means that the farming activity makes a contribution towards the fixed costs. In principle in the long term, if fixed costs could be avoided completely and there were no other consequences, then the business positions reflected in Table 6.3 would be £14k or £30k better off by stopping production. But of course, fixed costs can never be fully avoided, rents have to be paid, some activity will be necessary in order to be eligible for the agri-environment and HFA payments, and the farm will need to be maintained in Good Agricultural and Environmental Condition to be eligible to claim the Single Farm Payment. We might, quite arbitrarily, suppose that fixed costs could be halved by giving up agricultural production, that variable costs only involved £3000 per year payments to contractors, and that this management was sufficient to retain the agri-environment receipts, diversification income and Single Farm Payments on the Grazing Livestock Farm. For the grazing livestock farm, this would bring in a net income of £15k, but presumably free the farmer to find work elsewhere. Thus, income is reduced by something over £2k, implying that if the farmer could earn more than this elsewhere he would be better off giving up agricultural production. If the off farm income was £10k, this implies that it would be necessary to offer a payment of

around £8k to keep the business in agricultural production. These are of course purely imaginary numbers. On this basis, the required payment [P] to keep the farmer undertaking production is then:

[Potential off farm earnings] – [Agricultural output] + [Agricultural cost] – [Cost without production]

The position would clearly be different if there was no Single Farm Payment. In this case both farm types make a net loss and would seem not to be viable. This raises a variety of issues that should be explored. To what extent does the maintenance of GAEC achieve the desired environmental outcome, or is active agricultural production required? What are the costs of maintaining GAEC with out production and to what extent is it possible to cut down fixed costs? What are the minimum costs of operating a system so as to meet agri-environment and LFA requirements? What opportunities do farmers have for gaining income from sources other than farming, i.e. what is the opportunity cost of labour?

Given that these are average figures, it must be assumed that a considerable proportion of farm businesses are in this position. Entry into an agri-environment scheme will make little or no difference to the overall level of income generated. The logic of decoupling and the Single Payment Scheme thus means that agri-environment payments and subsidy income will have less influence on the overall behaviour of the farm business. However, as explained below, if farmers were simply subsidy maximisers then they would logically do the minimum level of farming sufficient to meet the requirements of GAEC and secure the SPS. But many farmers do not simply maximise subsidies, and farm largely because they want to farm in a way that brings self- respect and professional recognition from their peers

This then raises the question more generally as to what factors determine whether or not a farm business continues to undertake farming activity, even when it makes a loss. Recent research undertaken for Defra (Garforth *et al*., 2006) has emphasised the complexity of farm decision-making. It is argued that there are distinct behavioural categories, some driven more by business and economic motives and others more by environmental or family objectives. The evidence suggests that the Single Payment Scheme may have less influence on behaviour than expected. In a survey of farmers in England in January 2006, only 26% of respondents said that they intended to change their farming system and practices as a result of the Single Payment Scheme in the next 5 years, while the largest proportion, 44%, were still uncertain. Clearly the proportion changing their systems must be expected to increase over time, but the work indicates that farmers have a combination of different objectives, and weight these in ways that are themselves susceptible to change. Research of this sort may help to elaborate and explain decision-making processes amongst different categories of farmers, but it also indicates the challenge (or even impossibility) of identifying particular levels of payments that will be sufficient to maintain land under agricultural management.

Farm viability

Clearly if the farm business is not viable in itself, compensation for income foregone plus costs as a consequence of marginal changes associated with entry into an agri-environment scheme will not make it so. This indicates that in certain circumstances the determination of payments on the standard of income foregone plus costs alone will not ensure that the environmental goods are delivered. Rather the level of payment needs to be set at the

minimum amount required to retain occupation and management of the land in its desired state. Such an approach does not require that the particular farm businesses currently in occupation of the land has to be retained, but rather that the level of available returns has to be sufficient to attract enough businesses of the right type so as to attain the desired environmental objectives. The presence of different categories of farmer within the agricultural community may well suggest that the population should change in response to radically different farming circumstances, but of course, this would itself raise further questions and issues.

Farm business viability is determined by such a wide variety of factors such that it is not possible to calculate a particular minimum income level that is sufficient to keep a given area of land under management. Viability itself is a very imprecise concept. While the return to enterprises on the land is a critical issue, other factors will also be of importance. These include the individual farm business situation, the off-farm income available to the household as a whole and a variety of non-financial factors that may influence farm household decision-making. This takes the discussion of agri-environment payment rates and mechanisms into rather different areas of farm household behaviour, pluriactivity and rural development. It suggests that there may be closer links than is generally recognised between economic support for households in rural areas and the protection of rural environments, where the primary threat relates to land being taken out of some form of management. From an environmental perspective whether land coming out of agricultural management represents a threat or not depends on the type of land management required to maintain the desired environmental features - wilderness (no agricultural management) may be an acceptable outcome, but even this is likely to require some form of management.

The fact that it is not possible to calculate the precise level of income necessary to maintain any particular area of land under a desired form of management, might suggest that some form of competitive tendering may have a role to play. If such a process was used as a basis for letting contracts for land management in areas where agriculture is generally unprofitable, it could ensure that tenderers reveal information about their willingness to continue to manage land under a range of alternative circumstances. However, the discussion of competitive tendering elsewhere in this report casts some doubt on the long term efficacy of the approach and hence as to whether it offers a suitable solution to the problem of determining agri-environment payments where agricultural production is not profitable. In the absence of such an accurate pricing mechanism it is clearly important to monitor farming practices and related rural activity very carefully so as to detect evidence of any change in levels of management or signs of land being transferred into undesirable uses. It would seem to be possible to identify the circumstances in land management practices do undergo a change. It would also be possible to under take research onto the costs of alternative approaches to agricultural production, of meeting agri-environment requirements and of maintaining GAEC under alternative circumstances in order to generate some standard estimates of the payments that would, on average, be necessary in order to maintain the type of land management that is required to achieve environmental objectives.

7. The basis for assessment: Scenarios and criteria for evaluation

Introduction

The assessment of potential innovations for agri-environment schemes needs to be set in context. There are two aspects to this. Agri-environment schemes respond to the particular circumstances in which they operate. We have already commented on the way in which the emphasis of schemes have changed with the changes that have been made to the CAP and in the economic environment of farming. It is thus important to make explicit the assumption s about the contexts with in which innovations may be of significance. The chapter therefore starts by discussing the drivers of agricultural change, and presents four scenarios characterised by plausible but extreme levels of key drivers. In the following chapter these scenarios are used to evaluate how each proposal for future agri-environment schemes is likely to perform under that scenario. It is then important to make it clear as to the criteria against which the potential innovations will be assessed. We therefore go on to discuss in detail the evaluation criteria, on which we qualitatively evaluate proposals for agri-environment schemes in the next chapter.

Scenarios

Agri-environment policy developed under a particular set of circumstances. In the mid 1980s, with the level of commodity support maintained under the CAP, there were clear incentives for farmers to intensify their production activities through land drainage, removal of landscape features and the 'improvement' and intensification of grasslands. These investments generate positive financial returns, but were also found to be a cause of environmental damage. There were particular concerns about the loss of landscape features and the drainage of wetlands, but extension of more intensive agricultural production into marginal areas represented a threat to relatively rare and valued habitats and species. The application of the 'voluntary principle' established under the 1981 Wildlife and Countryside Act to the wider countryside meant that new agri-environment schemes had to offer compensation to farmers sufficient to attract them to participate on a voluntary basis. The basis on which payments were defined also followed the principles taken to the protection of SSSIs in being based on the level of income foregone as a result of following the prescriptions of the particular schemes, both in the Environmental Sensitive Areas, the Countryside Stewardship scheme, and similar schemes elsewhere.

Over the succeeding twenty year period, the financial returns to agricultural production tended to decline with changes to the operation of the CAP and relatively low commodity prices. These changes were reflected in the ways in which the agri-environment payments were calculated, but schemes were relatively attractive for farmers and the level of participation increased. The primary emphasis in scheme operation shifted from simply preventing environmental damage associated with agricultural intensification, where simply retaining the status quo would be regarded as 'success', towards an objective of environmental enhancement. And, notwithstanding the challenges of measuring actual levels of environmental change, it is generally accepted that improvements have on the whole been achieved; certainly if it is assumed that in the absence of the schemes there would have been generally greater levels of agricultural intensification.

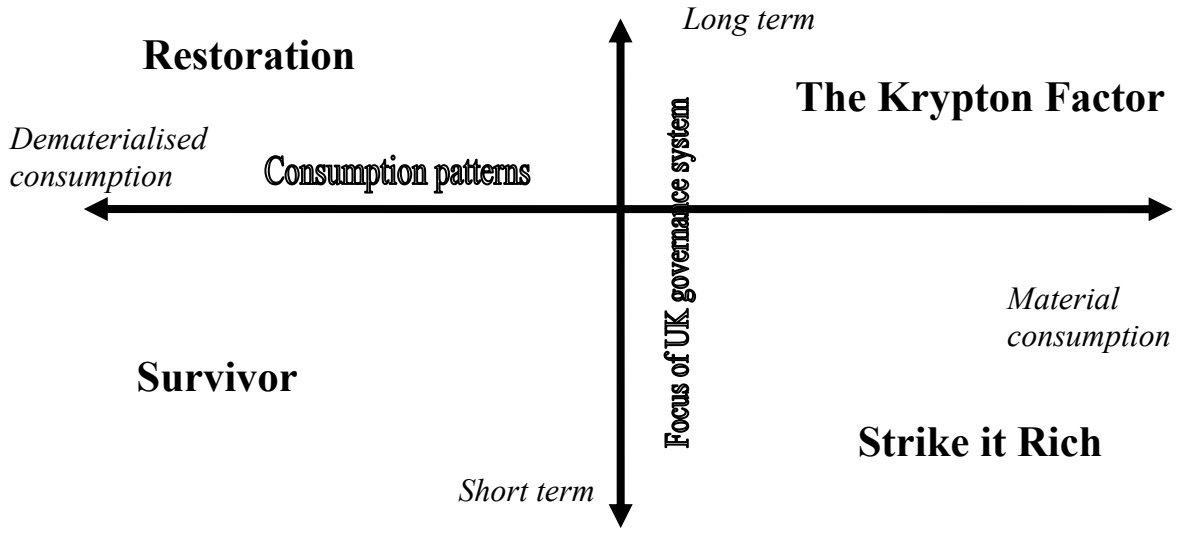
At the present time, the prospects for future levels of agricultural profitability, the incentives for agricultural intensification and the potential environmental damage are particularly unclear. The decoupling of agricultural support payments from production incentives, initially on a partial basis with the introduction of area payments under the 1992 MacSharry reforms, and subsequently, more fully with the introduction of the Single Payment Scheme (SPS), have reduced the incentives for intensification arising from the operation of agricultural policy. On the other hand, higher levels of market prices for commodities have increased the returns in agriculture and may lead to a return to greater incentives to intensify. Given the important implications of these factors for the ways in which agri-environment policy should be developed, it is helpful to set out alternative possible future conditions and to consider their implications for the ways in which agri-environment policy should be developed as from now. Consideration of these future possibilities can inform the ways in which agri-environment schemes may be positioned now in order to capitalise on the current conservation gains and protect against the future risks.

In this report, we explore sets of possible future circumstances by means of scenarios. As explained by Foresight (2002), scenarios are not intended to predict the future. Rather they offer a framework within which to review the future on the basis of explicit assumptions about how the various drivers and their outcomes may develop over a given period of time.

There are of course very many possible drivers and potential outcomes. Thus scenario development involves rational analysis and subjective judgement in selecting appropriate approaches on which to concentrate, given the particular focus of the analysis.

The objective in this study is to set out the potential relevant conditions under which agri-environment schemes will operate and the challenges that may be faced in sustaining the provision of public goods in the countryside. This might be approached either by means of broad, generic scenarios that describe developments across the economy and society, or they may be more focussed on the immediate circumstances that influence agri-environment policy. Recent work for the Environment Agency has looked at prospects for land uses within the context of wider, generic scenarios developed by Henley Centre Foresight Vision (Environment Agency, 2006), focussing on the potential circumstances in 2030. In developing their four scenarios, a wide range of drivers of change were considered against two intersecting axes of 'governance' (long-term to short-term) and 'consumption' (material and dematerialised). The four resulting scenarios, illustrated in Figure 7.1, were 'Restoration' (Long-term governance, dematerialised consumption), 'The Krypton factor' (Long-term governance; material consumption), 'Survivor' (Short-term governance; dematerialised consumption) and 'Strike it rich' (Short-term governance; material consumption). These scenarios, based on an analysis of a very large and complex set of potentially relevant drivers, sketch out the ways in which economic and social life develops over a thirty year period, leading to different, extreme outcomes at the end of the period. They then offer a context within which to review the ways in which alternative land uses and their environmental impacts may develop (Hodge, *et al*., 2006).

Figure 7.1: Henley Centre Headlight Vision scenarios developed for the Environment Agency



The approach here is somewhat less ambitious. It concentrates on the more immediate drivers of the condition of, and pressures on, the agricultural environment and looks at a shorter time horizon of around 10 to 15 years. While limiting its scope, this approach makes the analysis more transparent and more clearly relevant to the discussion of the implications for agri-environment schemes. The ways in which agricultural land is used will depend to a large degree on two sets of factors: the financial returns to the use of land for alternative purposes and the extent to which government regulates the ways in which land may be used or creates incentives for land to be used in particular ways. The drivers of agricultural land use to 2015 have been considered in detail by the Rural Business Unit and Land Economy Group (2006). Taken together, these factors essentially determine the combination of financial incentives and legal constraints that govern choices of land uses. They do disregard the non-financial factors that influence landowners, such as the personal incentives or social expectations that may in practice also have an influence. However, these factors would seem likely to be less important and are, anyway, particularly difficult to measure and predict. We also ignore the transfer of land out of agriculture and into either urban use or forestry. This is because the proportion of the total land area that is transferred over this time period will be relatively small and the management of the environmental implications of these changes takes us beyond the realm of agri-environment schemes. These are thus issues for further research.

Demand for rural land for alternative uses: returns to domestic agriculture

Market returns to land will depend on a variety of factors generated both nationally and internationally. A number of factors illustrate the sorts of uncertainties that are faced.

- *Economic growth: demand for products from agricultural land*

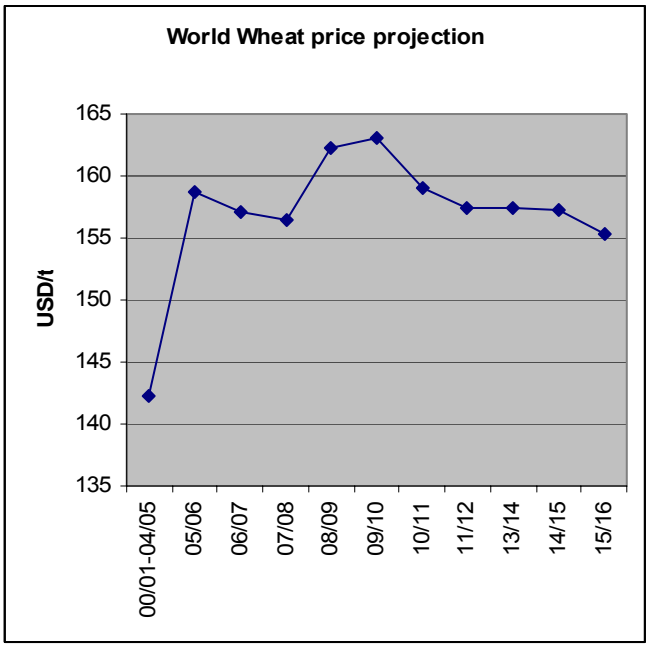
Higher levels of economic growth will increase the levels of demand for the products of agricultural land and so create incentives for the land to be used more intensively. However, the impact of domestic economic growth on the level of demand for domestic agricultural products is probably relatively modest given the low income elasticity of demand for food in

rich countries. It is possible that economic growth promotes a higher level of environmental concern, but in the absence of markets for environmental goods, such an effect is more likely to influence government in determining whether and to what degree to implement environmental policies.

- *World commodity prices*

International commodity markets will be major determinants of future market returns to land in the UK, especially where the degree of government intervention in trade has been minimised and this in turn depends on the progress of international trade negotiations. Price projections are available from various organisations. Projections of world wheat prices are illustrated in Figure 7.2. The 2006 projections suggest prices rising to $163/t in 2009/10 and then falling slightly. However, price forecasting is an uncertain art and we might note that the USDA report French wheat prices rising to over $200/t in November 2006 indicating the degree of uncertainty involved.

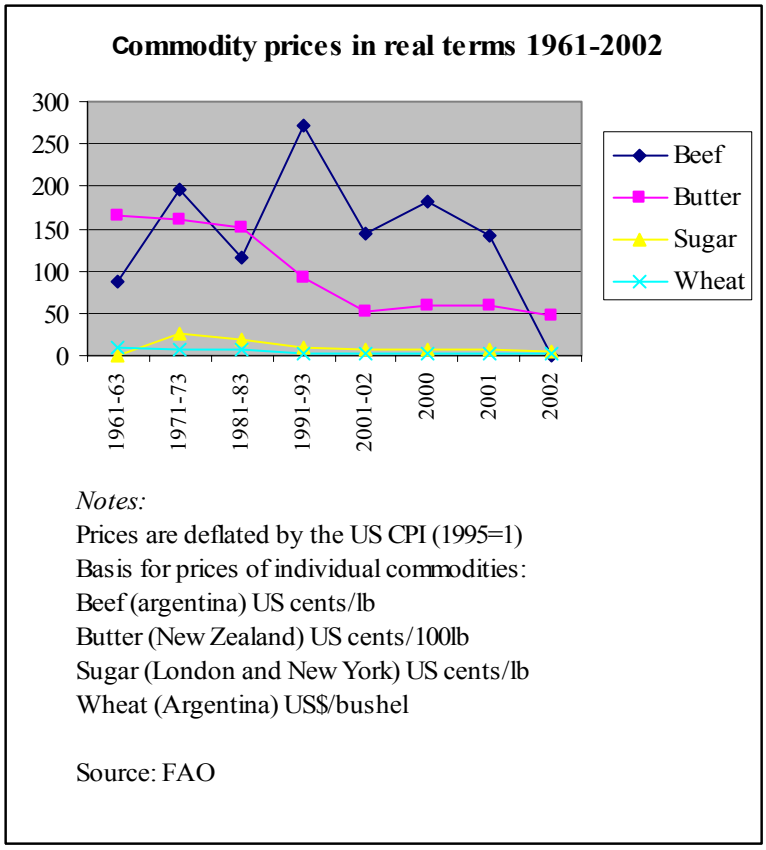
Figure 7.2: World Wheat price projection to 2015/16



Source: OECD-FAO Agricultural Outlook, Highlights, 2006

However, while the recent trend in prices appears to be upwards, it has to be recognised that a decline in real prices has been a more common experience, as illustrated in Figure 7.3.

Figure 7.3: Commodity prices in real terms 1961-2002



Source: Data from FAO 'The State of Agricultural Commodity Markets, 2004'

- *Energy prices and policy: carbon and security policies*

There is considerable debate at present about the potential for energy crops to contribute renewable substitutes for petroleum products and this has been emphasised by concerns for climate change and the security of oil and gas supplies. There is considerable interest in the potential of energy crops, and major investments in the production of ethanol are underway in the United States. A significant growth of the production of biofuels could have a dramatic impact on land use. Eyre *et al.* (2002), for instance, estimated that in order to supply around 15% of primary transport energy in the UK would require 4 Mha of land, equivalent to two-thirds of current arable land. The actual take-up of energy crops will depend on very many factors; there is a wide variety of options relating to the crop type, production system and fuel type. This would clearly act as an incentive to intensify production and exert a renewed pressure on the use of land for agri-environmental public goods. Under present circumstances, market returns to most forms of energy production from agriculture are insufficient to stimulate major levels of production (Rural Business Unit and Land Economy Group, 2005) but the position could alter quite quickly in response to global oil prices and government policy. This creates a high degree of uncertainty with regard to the likely production pressures on agricultural land in the coming years.

- *Levels of protection for the domestic market*

Of course, much also depends on the levels of protection given to agricultural products. The UK government favours fundamental reform and envisions that within the coming 10-15 years agriculture should be rewarded by the market for its outputs, without reliance on subsidy or protection and by the taxpayer only for producing societal benefits that the market

cannot deliver (HM Treasury & Defra, 2005, p9). While the UK government takes a rather different view from other EU member governments, EU expenditure on agricultural policy seems likely to continue to be under pressure in the coming years. However, the extent to which this will prompt a more comprehensive dismantling of the CAP is uncertain. A House of Lords committee (House of Lords, 2005) has argued that the level of SPS is almost certain to decline over time given the internal EU financial pressures associated particularly with enlargement of the European Union. But any possible future progress with the Doha round of WTO talks could also be a factor leading to further pressure for reform at a European level. As at the start of 2007, it seems uncertain as to whether or not all hope of reaching an agreement in the Doha rounds of trade talks has been lost or whether they may be restarted. Again, this represents a further source of uncertainty over land uses.

- *Single Payment Scheme*

The reforms of the CAP introduced under the mid term review of the CAP have made a significant contribution towards the decoupling of support payments from production incentives. In England, the level of the SPS has been based initially on historic direct subsidy receipts, the average of 2000-02, but the basis for the payment shifts progressively from this historic rate, to a flat rate payment that is equal across most areas. This becomes a wholly flat rate payment by 2012. In other countries, payments remain linked to historic production levels. In order to be eligible to receive the payment, farmers still have to enter land into set-aside and this requirement is extended to cover temporary grassland as well arable land. They also have to meet certain cross-compliance requirements. These have two elements: compliance with Statutory Management Requirements (SMRs) in relation to 19 European Union regulations and directives, and to attain Good Agricultural and Environmental Conditions (GAECs) as defined by individual member states (Bennett, *et al.* 2006).

The introduction of the SPS means that current agricultural production decisions have no impact on the size of the subsidy payment received, from which it might be concluded that the payment has no influence on production decisions, *i.e.* that the payments are fully decoupled. In principle this would be the case for a rational profit-maximising producer who would simply stop any activities that were not covering their costs. However, in practice farmers will be likely to use the SPS to cover losses made in their production activities to enable them to continue in farming. The evidence suggests that most farmers are responding cautiously to the changes in policy, but in the longer term, it must be assumed that the extent to which farmers are prepared to cross-subsidise their losses will decline as they clarify their options and rationalise their business activities. In fact, a substantial degree of agricultural adjustment and restructuring has been underway for several years, particularly involving a variety of tenure and contracting arrangements that often separate ownership and responsibility for the land from the conduct of farming operations. This means that it is difficult to assess the extent of adjustment from the available conventional farm-based statistics. It seems probable that over time, given the pressures on the European budget and the demands for expenditure from the new member states, the real value of the SPS will tend to decline reducing the level of leverage available for cross-compliance. It also seems likely that set-aside requirements will be eased or completely stopped, removing another mechanism that has had a significant impact on environmental quality (Hodge, *et al*., 2006).

- *Biosecurity and food quality issues: interfering with international trade?*

A final issue that we will highlight that represents a significant uncertainty relates to biosecurity. Agriculture has been afflicted in recent years by a number of major animal health problems, from BSE, Foot and Mouth disease, swine fever and avian flu. These all

have major implications for trade in livestock and livestock products and some have potentially dire implications for human health. It is clearly possible that outbreaks of disease in other countries could stimulate a ban on food imports and an increased demand for production based within the UK. Less dramatically, but potentially associated with it, we might simply see an increase in the demand for domestically produced products because the products are or are perceived to be of lower risk or of higher quality, because their provenance is better documented and more transparent or because their production involved fewer food miles. These sorts of factors could see an increased demand for products produced in the UK and so an increased level of pressure on land for agricultural production.

Government willingness to invest or regulate for environmental objectives

A second set of factors will influence the degree to which the uses of agricultural land are influenced by government environmental and agri-environmental policies. There is similarly a high degree of uncertainty here too, although the range of possible outcomes over the next decade or so would seem to be somewhat narrower. The issues relate primarily in the degree to which European or UK policies regulate external costs or promote the external benefits and public goods that may be generated from the uses of agricultural land.

- *European Union budget and the further development of the CAP*

Perhaps the most immediate factor concerns the level of funding that will be available for the implementation of agri-environment schemes. The UK has historically spent relatively little on agri-environment schemes as a proportion of the total agricultural budget and in turn has received relatively little turn under the EU rural development budget. Compulsory modulation[10] of the SPS is likely to be supplemented by additional "national level voluntary modulation" assuming that the necessary EC regulations can be put in place despite the opposition of the European Parliament. In the longer term agri-environment budgets will also depend on the way in which Rural Development policy is implemented more generally and whether there is progressively more emphasis on off farm rural development measures under Axis 3 and Axis 4. Much of the period in question will be covered by the operation of the current Rural Development Regulation (RDR)

- *Rural Development Programme funding*

The RDR is implemented through the Rural Development Programmes developed at both Member State and Regional levels to cover the period 2007- 2013. The new regulation includes four priority axes for spending (axis I: agricultural and forestry competitiveness; axis II: land management; axis III: wider rural development and axis IV: LEADER, a horizontal delivery mechanism), with detailed measures under each axis, together with a requirement that a minimum of 25% of community support for each rural development programme to be spent on axis II. This offers some degree of confidence with regard to policy expenditure on agri-environment schemes over this period, although it doesn't define the total level of expenditure. But there must be much greater uncertainty as to the period beyond 2013.

[10] Modulation is the EU term for transfers of funds from one budget heading to another (e.g. reductions in 'direct payments' being spent on 'agri-environment' measures).

- *EU environmental policies (nature conservation and water quality)*

There are of course a range of other European policies that will influence the environmental impacts of agricultural land uses, particularly regulations relating to Nitrates, the Water Framework Directive and nature conservation.

- *UK and national government policies and expenditures*

The importance of European legislation relating to the environment reduces the degree of discretion over environmental regulation available to the UK and national governments. There is though some degree of flexibility both in terms of the ways in which European requirements are implemented and in terms of the introduction of other measures.

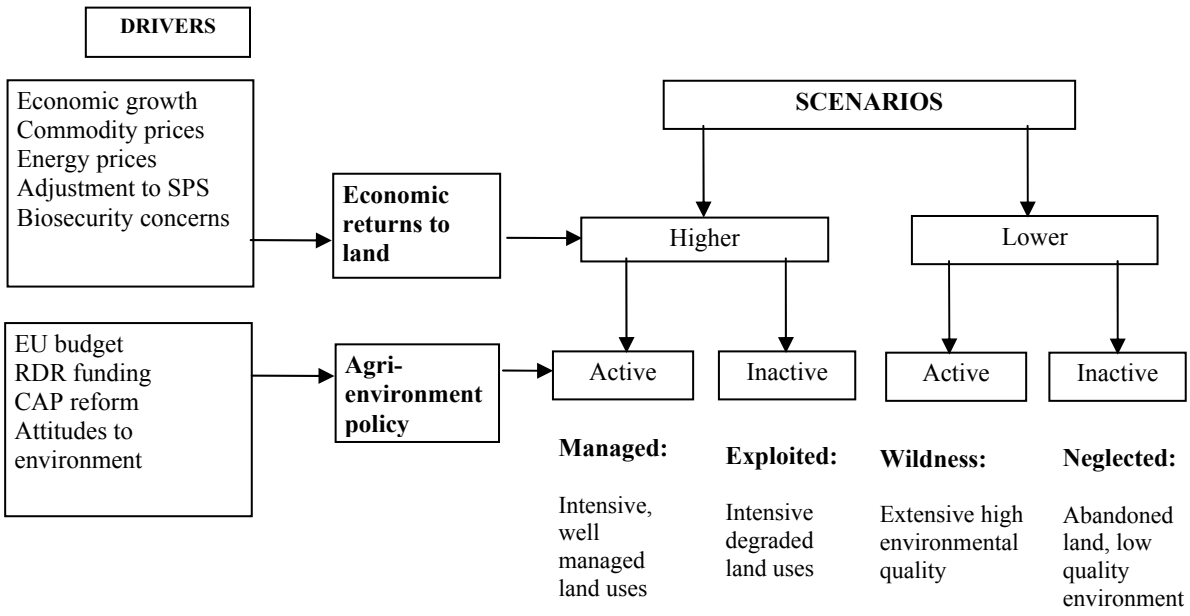
- *Public preferences for environmental quality (economic growth, education)*

Government decisions will be substantially influenced by the attitudes of the public towards environmental policies. But the quality of the rural environment will also be influenced by the direct activities of the voluntary conservation sector, by consumers willingness to pay extra for products that can generate 'environmental' products and by the norms and behaviour of land managers with regard to the environmental impacts of their operations.

The Scenarios

Concentrating on these two groups of factors suggests some potential scenarios. Economic returns may be either higher or lower and government policies towards the agri-environment may either be active or inactive. These represent four possible scenarios as illustrated in Figure 7.4 that we term 'Managed', 'Exploited', 'Wildness', and 'Neglected'.

Figure 7.4: Scenarios for agri-environment schemes



We may then sketch out some of the immediate implications of these four alternative scenarios. Generally we may note that in the presence of relatively high financial returns to agricultural production activities, the opportunity costs of conservation activity will be higher and so it will be more critical to target a given volume of funds available for conservation more carefully on critical land areas and conservation values.

Managed

In the 'managed' scenario financial returns to land are relatively high and so producers face an incentive to intensify their agricultural production. This indicates that the opportunity cost, or the income foregone from reducing intensity or placing land into conservation uses is also relatively high. But this is counteracted by active agri-environmental and environmental policies. This may either be sufficiently funded in order to provide agri-environmental payments so as to ensure that adequate areas of land are farmed in sufficient ways as to protect landscape and biodiversity objectives, or else regulations may be imposed on farming practices in order to mitigate the potential environmental impacts. In practice, some combination of these approaches may be required, but the implications of the relatively high opportunity costs is that conservation activity would need to be more highly targeted on higher priority, more critical areas for conservation.

Exploited

There is no reason to presume that high returns to agricultural production activities will be accompanied by an active agri-environment programme. The 'exploited' scenario assumes that there is no compensatory agri-environment scheme and that production pressures are not mitigated. This position would be similar to that in the 1970s and early 1980s when production incentives, in that case driven by government commodity market support measures, led to significant environmental losses. With regard to the future, it is probably more likely that the production incentives would result from higher world commodity market prices, one of which might be high oil prices and political uncertainty with regards to food or energy supplies, rather than general protection for agricultural commodity prices. However, it is possible that in these circumstances government may see the energy crops as a priority and so provide financial specific support for their production. Any funds that are available for the government policy in support of conservation would need to be very carefully targeted at measures designed to prevent the irreversible loss of the most valuable conservation assets. The conservation value of the rural environment in these circumstances would then depend to a great extent on the security of the conservation measures introduced in previous time periods. Thus, a threat of this scenario occurring would provide a rationale for the adoption of measures, such as land purchase, that give greater security for conservation of the rural environment, even at the expense of its covering a smaller total area of land.

Wildness

An alternative prospect is that we return to the longer term decline in the levels of commodity prices and that returns to agricultural land uses in the UK are low. This would promote more extensive land uses and, depending on government responses, the potential for land to be abandoned. In this context, it is the lack of agricultural management that represents the primary threat to conservation and landscape values. There would be some environmental advantages, such as reduced emissions of minerals or pesticides from agricultural production, but the lack of management would also have detrimental effects in terms of landscape and biodiversity. The lack of management is most likely to arise in the uplands, but could also affect lowland areas too, especially with regard to problems of undergrazing. However in this scenario, it is assumed that there is an active agri-environmental policy. With relatively

low returns to agricultural production, the opportunity costs of conservation activities would be low with the implication that an agri-environment policy with a given level of funds available could influence land uses across a relatively large area. We might then envisage ambitious schemes to reorient large areas of land towards conservation uses.

Neglected
With low financial returns and without any active agri-environmental policy, land would be commonly unmanaged in way not seen since the 1930s. Agricultural land prices would be low and so there could be some more positive intervention by private individuals and conservation organisations who may be attracted to acquire land to be managed for environmental values. The extent of such activity in the absence of strong government environmental policy clearly depends on attitudes towards the rural environment and the willingness of individuals to allocate their own resources towards it, either individually or collectively through non-profit organisations. Government policy should be targeted on conservation values that are most threatened by neglect and abandonment and of less immediate attraction to the general public.

Limitations of scenarios
As we have indicated, in practice the factors identified may well pull in different directions leading to more complex but probably less extreme outcomes. Similarly there may be circumstances where public preferences are favourable towards the environment, but where public policy is not. This would place a greater emphasis on market and voluntary initiatives. Thus the policies that are operated may be better oriented towards seeking to direct private actions towards socially valued outcomes rather than adopting the more direct forms of government action that have tended to predominate in agri-environmental policy to date. We might, by way of illustration, note the experience with conservation easements in the USA in indicating some of the potential and limits of a more privately oriented approach.

Criteria for evaluation

The purpose of the project is to fundamentally examine the way in which countryside public good objectives can be achieved. In assessing the relative merits of alternative innovations we thus need to identify some criteria by which they may be compared. We are doing this in advance of any implementation, i.e., this is an ex ante rather than an ex post appraisal which obviously means that the information available is even more limited. And we should note too that the potential innovations are themselves only sketched out in rather general terms.

The evaluation of alternative policy approaches will relate to a variety of factors, many of which would be difficult to quantify in practice. In principle we might seek to undertake a cost-benefit analysis whereby all of the impacts, both positive and negative, would be quantified, valued in monetary terms, added together and then looked at in present value terms so as to determine a net present value for the approach as a whole. We clearly don't have the data by which to adopt this approach, and even if we did, it may be argued that such an approach embodies unacceptable assumptions and omits some significant elements of a comprehensive evaluation. It is argued for instance that costs-benefit analysis is too restrictive in assuming that preferences are fixed and known over the period of the evaluation, whereas in practice one of the purposes of policy analysis and public debate may well be to influence public preferences towards some type of consensus. Nevertheless, a cost-benefit framework does help to identify many of the issues that are critical to an

effective evaluation. The criteria identified here start from a cost benefit perspective and then add some further aspects that are often not readily incorporated into it.

- *Environmental impacts: what evidence of environmental impacts?*

A first consideration for any potential innovation to an agri-environmental scheme will be to judge whether or not it will have any impact on the ground in practice. This is in itself not straightforward. We have already drawn attention to the difficulty that has been experienced in determining the impacts of agri-environment policies that have been implemented in the past (see under Chapter 3. "Evidence of demand for public goods") and yet the purpose here is to anticipate the impacts of potential innovations in the future. We are thus likely to have to make assumptions that innovations that, for example, have the potential to direct more resources towards agri-environment schemes or to promote better co-ordination across land areas may be expected to have positive impacts on environmental outcomes.

- *Precision (efficiency less transactions costs): How accurately are the benefits targeted?*

We also consider the 'precision' of the potential innovation. Vatn (2002) defines a precise solution as being reached when the standard conditions for optimality are met in the production of the good (*i.e.* marginal cost equals marginal benefit) and thus precision represents the closeness to optimality in those terms. Conventionally this would be termed as efficiency. However, it is also important to take account of transactions costs which are the costs involved in establishing and running a policy that are often not included in assessments of efficiency: collecting information, formulating contracts and monitoring and enforcing them. These are incurred both by government and by the private actors who are affected by the policy.

Precision will be increased by targeting resources on actions that generate the greatest return in respect of conservation benefits. This applies in terms of targeting locations where potential conservation benefits are high, in terms of persuading farmers to adopt management practices that will generate the greatest conservation benefits and in terms of directing funds towards those farmers who will change their behaviour in response to the payments made to them.

- *Transactions costs: what administration costs of implementation and what benefits do they generate?*

Transactions costs can be high in some agri-environment schemes and so it is important to take them into account. There is generally a trade-off between precision and transactions costs. With more information and more detailed contracts, governments can implement policies for land uses that deliver a more valuable package of countryside goods prescribing the least cost method of provision. This will take account of both supply considerations, in terms of the capacity for local areas to supply countryside goods using alternative means of provision, and demand considerations, taking account of the demand within that local situation, given the size, location and preferences of the affected population. But the acquisition of such information is expensive and in practice the information available to government is always imperfect, particularly affected both by the degree of spatial heterogeneity in supply and demand conditions and by the incentives that decision-makers face to hide information and actions

- *Dynamic incentives: flexibility and incentives to respond to changing circumstances*

This suggests a somewhat static view. In practice the optimal approaches to the provision of countryside goods change over time. New information and techniques can respond to changing preferences and reduce costs. As a further criterion we also consider the dynamic incentives within a system for land management decisions to seek out opportunities for the provision of countryside goods and methods by which production costs might be reduced.

- *Security against future changes*

The progress that has been made with the development of agri-environment policy over the past twenty years is maintained and extended through the operation of contracts with individual farmers. At the end of the contract, either the farmer has the option of withdrawing land from the scheme, in which case any environmental gains may be lost, or the government may decide to end the scheme. However, other policy instruments, such as land purchase, have the potential to offer longer term security for environmental gains and this could be attractive where it is anticipated that farmers may choose to opt out of contracts when they are given the opportunity.

- *Leverage: does it draw in resources from non-governmental sources?*

Leverage relates to the extent to which the countryside goods delivery mechanism draws in resources and information from members of the public who place a particular value on their provision. Agri-environment policy has been implemented almost wholly in terms of central government payments, with some reimbursement from the European Union, to individual farmers. But other approaches are possible that promote more market and private sector approaches through the demand for public goods, either through linked markets or through intermediate non-profit organisations. These alternative approaches have the advantage that they can shift the burden of provision onto the beneficiaries who value them. They may bring in resources for their provision at lower opportunity cost. They can reduce the role of the public sector and so avoid some economic distortions associated with taxation and the problems associated with government bureaucracy. In some circumstances, especially where public expenditure for agri-environment schemes is under pressure, there may be particular merit in seeking mechanisms where non-governmental funds are drawn in support of the agri-environment.

- *Property rights and wider acceptability: would it have political support?*

A wider assessment issue concerns whether or not a particular innovation would be regarded as being fair. It might be possible in principle simply to remove property rights from land owners in order to achieve a particular objective. But this may be regarded as unfair and so be difficult to impose politically. There may be other more general issues, such as whether those who gain the benefits from a particular measure should be expected to contribute towards the cost or whether a approach may be seen as placing an unreasonable burden on people on low incomes.

8. Potential innovations and their contribution

The case studies and other discussion have indicated a variety of potential innovations that could be included in agri-environment schemes. In this chapter we consider nine innovations. For each one we briefly outline the innovation itself, and then consider its attributes, first against the seven criteria identified for evaluation and then against the four scenarios.

Rebalancing the ELS: adjusting priorities

Entry level schemes are new and have given farmers free choice to select options. Farmers will generally have selected options to minimise the net cost and there is little reason to expect that the outcome will reflect the social values of what could be produced. The level and spatial pattern of conservation outcomes could be altered by rebalancing the payments offered for the different options at either national or regional levels.

Criteria

Impacts	Problem of adverse selection implies potential deadweight cost.
Precision	Potential for greater targeting with scheme modification
Transactions costs	Relatively low transactions costs of implementation although potential problems of monitoring and enforcement for a scheme implemented across very large area with many different options for which it is difficult to observe implementation in practice.
Dynamic	Fair degree of flexibility but limited by the period over which contracts with farmers are agreed. Does have potential for offering additional options as a top up to those already enrolled in the scheme.
Security	Relatively little security against future changes: farmers can opt out quite easily.
Leverage	No leverage from non-governmental sources, in fact may 'crowd out' voluntary stewardship by commoditising provision of public goods.
Acceptability	Allows landholder to retain property rights. Political support might depend on the extent to which actions supported are regarded as being above the reference level of property rights (*i.e.* not seen to be paying farmers for doing things that they should be doing anyway) and to which it can be demonstrated that the scheme makes a real difference to the way in which the environment is managed with identified environmental enhancements..

Scenarios

Managed	Provides government with an active framework to implement agri-environment schemes across rural environment as a whole. This becomes more significant with fundamental reform of the CAP where the cross-compliance leverage of SPS is lost. It is also of greater importance under the 'managed' scenario where demands for land for agricultural production is relatively high. Potential role as a substitute for set-aside could be of particular importance in meeting WFD water quality requirements. May need to target on catchments at risk. The cost of the scheme could be relatively high, but assumed that this would be met where government policy is favourable towards agri-environmental policy.
Exploited	This scenario represents the greatest threat to rural environmental quality. It would seem unlikely that in this context government would continue to operate an active and wide-ranging agri-environmental scheme. Other initiatives may have the potential to do more, but it is possible that government might operate a more highly targeted ELS on the basis that the administrative costs would be relatively low. This might operate on a more competitive basis, perhaps along the lines of the use of the Environmental Benefit Index under the Conservation Reserve Program in the USA.
Wildness	This scenario gives considerable scope for a wider-ranging scheme influencing land management across a substantial proportion of the agricultural land area.
Neglected	There may be little role for an ELS where threats to the rural environment are associated with neglect and abandonment and where government has little interest in environmental conservation. However some low level scheme could be of value in the most critical areas.

Collective schemes: co-ordination at landscape scale (environmental co-ops and collective contracts)

Collective schemes are currently available, as for instance under the CSS and HLS. However, two particular aspects of collective schemes may be worthy of further development: (i) the 'co-operative environment': improving the general environment within which farmers engage with agri-environment policy and rural development, and (ii) 'collective contracts': contracts made between government and a groups of landholders on a collective basis allowing greater discretion to scheme participants to determine the way in which requirements are defined and payment rates are determined for individual scheme members.

Co-operative environment

Promoting co-operative organisations in support of individual participation in agri-environment schemes such as environmental co-operatives or wider stakeholder groupings such as under the Landcare movement. They would provide support and facilitation to individual co-operative members, promote education and exchange of information and provide a forum where groups of landholders might identify common interests and objectives and opportunities for joint projects.

Criteria

Impacts	May encourage individual applications for agri-environment schemes and improve management standards. May promote co-ordinated initiatives from groups of farmers both for participation in agri-environment schemes and in other environmental initiatives, such as marketing schemes.
Precision	Higher numbers of applications would allow more selectivity in accepting applicants
Transactions costs	Some costs in supporting intermediate organisations and to government agencies and voluntary organisations. Questions as to whether these organisations are allowed to be funded using agri-environment funds.
Dynamic	Better exchange of information amongst agencies and landholders. Dissemination and exchange of information with groups will promote better management methods.
Security	Collective engagement may help to lock in individual participants.
Leverage	Levers in involvement from voluntary organisations where organisations embrace non-farming participation. May facilitate working between environmental co-operatives and conservation organisations.
Acceptability	No change in property rights. Need to accept public funding for administration costs.

Scenarios

Managed	Getting land into schemes is important as is widescale coverage over the agricultural area. Resources could be available from government to support it; co-operative organisations could help in this process.
Exploited	Limited funds available. Farmers would tend to opt out of agri-environment schemes where they can leaving land unprotected. Co-operatives might encourage individuals to hold together and continue to support the environment, or else they might provide better information on the enhanced agricultural production opportunities and so encourage farmers to opt out of schemes more quickly.
Wildness	Co-operatives might help to disseminate information amongst landholders in areas that go through radical changes in land uses, where conventional production activities are not viable.
Neglected	Co-operation might promote informal co-ordination of land management in extensively farmed areas.

Collective contracts
Expanding the use of contracts between government and groups of landholders who would determine the details of the arrangements with individual members amongst themselves. They would have their own responsibility for the implementation, monitoring and enforcement of the terms of the contract.

Criteria

Impacts	Potential contribution in areas of high levels of interaction between properties, complex property rights and ownership and where there are economies of size in provision of countryside goods, especially for provision at a landscape scale. Risk of hold out by individuals who choose not to join in with rest of group.
Precision	Increases potential for larger scale schemes in significant environmental areas.
Transactions costs	Need for organisation for management of collective contract implies relatively high costs for both public sector and private organisation. However there may be potential for internal monitoring and enforcement within the group that reduces the problem of asymmetric information with government.
Dynamic	Local organisation could be responsive to changing circumstances and opportunities as it would have the scale invest resources in acquiring information and education. Or alternatively it may become bureaucratic and inflexible
Security	Could tie in individuals to community support and collective agreements.
Leverage	Voluntary bodies may act as facilitators or even as core landowners, perhaps equivalent to 'keystone tenants' who set the context for participation by smaller private landholders. Groups of willing participants may get together and participate at low cost.
Acceptability	No change in property rights. High acceptability

Scenarios

Managed	Substantial funds required but high potential gains in this scenario. Collective contracts might provide opportunities for landscape and catchment scale schemes.
Exploited	May find groups willing to participate against the more general trends towards greater agricultural production intensity.
Wildness	There may be groups of landholders willing to put land into very extensive management systems over long periods of time who could work within collective contracts.
Neglected	Some groups might develop commitment over time and be willing to continue even when public funding falls.

Tendering: cost-effective purchasing
Use of tendering or auction mechanisms for the allocation of agri-environment contracts.

Criteria

Impacts	Little difference
Precision	Some degree of costs saving probable in the short to medium term, but extent of long term savings uncertain.
Transactions costs	May be somewhat higher
Dynamic	No change
Security	No change
Leverage	No change
Acceptability	No change in property rights. Some resistance from farmers and administrators to the competitive nature of the process.

Scenarios

Managed	The value of competitive tendering depends on the balance of potential gains in cost-effectiveness against any changes in transactions costs.
Exploited	Increased importance of cost-effectiveness given the overall limits on government funds for agri-environment schemes and so competition within schemes becomes more important. Market-based approach may be consistent with government philosophy?
Wildness	Depends on the balance of potential gains in cost-effectiveness against any changes in transactions costs
Neglected	Increased importance of cost-effectiveness. Market-based approach may be consistent with government philosophy?

Land purchase: long term and specialist management
Purchase and subsequent management of land by government or non-profit organisations

Criteria

Impacts	Secure long term control to achieve ecological objectives. Provides context within which specialist knowledge and advice may be applied to sites of particular importance.
Precision	Can apply specialist management and knowledge with complete control over land use. Reduces the requirement for the land to generate a positive net return to the owner provided that there are other sources of funding available. But limits the scale of the area over which influence can be exercised.
Transactions costs	Higher legal and administrative costs of land transactions
Dynamic	Locks influence over land management into a particular location but permits specialist management responses within the owned sites.
Security	Highest level of security possible.
Leverage	Can use public funds to stimulate further voluntary fundraising for CART land purchase (e.g. by matched funding scheme).
Acceptability	No change in property rights unless element of coercion on land transfers. Reduces levels of transfers within agri-environment schemes to farming population and the total area to which funding is applied that may be unattractive politically. May be concerns about impacts of government actions on market prices. Political reluctance to become heavily involved in land market transactions.

Scenarios

Managed	Funds may be made available for targeted land purchase, but reduces degree of influence across land area as whole. This would be less critical in a well funded agri-environment scheme. Lower pressure to distribute funds equally across farming community because of the relatively high farm income levels. Secure ownership may help to defend against profitability of higher production intensity.
Exploited	Limited funds for public land purchase, but leverage important and grants may stimulate CART land acquisition. But the concentration of any available funds on land purchase would lose any influence over the wider countryside. It is now too late for land purchase. Land acquisition in *previous* periods would have been especially valuable for locking in conservation values in this scenario.
Wildness	Funds available can have extensive influence over land uses. Land purchase seems less critical.
Neglected	Land purchase by private groups and individuals more likely than government funded purchases.

Regulation
Introduction of greater regulation over the way in which rural land may be used.

Criteria

Impacts	Places limitations on measurable actions by landholders
Precision	Limited to restrictions, limits on targeting – will typically involve a standard requirement on all landholders within defined zones.
Transactions costs	Low transactions costs
Dynamic	Conventional regulations have limited flexibility to respond changing circumstances, although can in some circumstances be used for technology forcing.
Security	High for what is regulated. Opportunity costs imposed on landholders.
Leverage	None
Acceptability	Removes property rights from landholders and thus defines what is being prevented as an external cost, i.e. as pollution rather than potential external benefit. Imposition of regulation will be controversial unless very strong social consensus that it is consistent with the fair allocation of property rights

Scenarios

Managed	Voluntary schemes are expensive given the high opportunity costs, but funds are made available. Pollution risks may be ameliorated by underpinning regulation.
Exploited	Voluntary schemes are expensive given the high opportunity costs and so regulation could be primary protection for environment. This may be acceptable to a government that is less committed to environment. This will depend on whether the lack of commitment reflects an unwillingness to allocate funds for environment or a simple lack of concern for environmental values.
Wildness	Regulation may not be necessary given relatively low threat from pollution and an active agri-environment scheme. More important to promote positive land management in this scenario.
Neglected	Regulation may prevent worst excesses in the absence of active agri-environment scheme, but remains difficult to regulate to maintain land management.

Alternative funding sources: markets and local funding

Promoting markets for agricultural products jointly produced with countryside goods by means of support for farm projects, feasibility studies, marketing etc. Uncertainty as to the extent to which such schemes can have environmental impact. The overall impact is probably limited although may have more general rural development value.

Criteria

Impacts	Uncertain relationships between linked markets, such as markets for local and niche products, and positive environmental impacts. To what extent does the production of particular product promote higher environmental quality as compared to position where product is not sold. But any extra farm household income might enable farm to continue in operation.
Precision	Land use impacts not necessarily targeted towards valued changes in any deliberate way, but costs are also low. Market test (consumers' willingness to pay for the products that are sold) implies that their value exceeds the costs irrespective of public good benefits to non-consumers.
Transactions costs	Minimal although government involvement may be required in setting up the terms of the market transactions (standards, labelling etc) and administering grant funding process.
Dynamic	Responsive to consumer preferences.
Security	Low, vulnerable to market changes.
Leverage	High: once the activity is established it is driven by consumer rather than public expenditure.
Acceptability	No change in property rights. High acceptability.

Scenarios

Managed	Could make a contribution towards environmental objectives. Do government schemes crowd out market and voluntary mechanisms?
Exploited	Contribution from near market schemes could be more significant in the absence of government funded schemes in the face of environmental pressures. Depends on whether lack of government policy also reflects lack of public concern, in which consumers may not be willing to pay higher prices for local or niche products.
Wildness	Could have value but contribution probably least critical in this scenario.
Neglected	Land prices likely to be low and so enhanced scope for private and voluntary schemes.

Conservation easements / covenants / conservation burdens in Scotland
Separating out of certain property rights from bundle held by landowner. The right may be transferred to government agency or to recognised non-profit organisations by means of either a commercial purchase or else on a voluntary basis by a donation from the landholder who wishes to ensure the conservation of their property into the future. Government may provide financial support to enable such transactions to take place.

Criteria

Impacts	Can provide long term security for conservation land uses. Land use requirements have to be written into rules that can be enforceable. This limits the range of land management requirements that may be appropriate.
Precision	Can represent local preferences to extent funded by local voluntary donations but concentrates on high profile public goods. Can secure land use objectives at much lower cost per unit area than is required for land purchase.
Transactions costs	Relatively low, may be borne by voluntary groups.
Dynamic	Has the potential to freeze land uses in sub-optimal patterns.
Security	Can be in perpetuity.
Leverage	High: public funding can lever in private donations. Private individuals may seek out opportunities to protect the conservation value of their own land in the long term.
Acceptability	No change in property rights in that they are market based instruments. High: generally reflects public preferences. Uncertain about the legal position of conservation burdens in Scotland. Would require primary legislation in England and Wales to establish a flexible system with private involvement.

Scenarios

Managed	Provides less sensitive influence over land management than is the case with conventional agri-environmental contracts. Thus this approach may have less relevance in the context of well funded and active agri-environment policies. They may also run the risk that they could lock in sub-optimal land uses, such as preventing intensive agriculture on areas of land where that becomes the socially desirable land use.
Exploited	Can provide long term security for conservation gains made when public funds are available that carries over into periods when they are not. Can provide a low cost, privately funded mechanism. As with land purchase, the critical issue will be whether the covenants have been established in preceding periods. They could then be of very great conservation value in this scenario.
Wildness	Provides potential for voluntary groups to take opportunities while opportunity costs are low to promote widespread conservation across large areas.
Neglected	Covenant prices would fall alongside land prices giving voluntary bodies influence over a larger land area. This would be of particular value in the absence of an active agri-environment policy.

The production of agri-environmental plans

Public goods from agri-environment schemes are of potential value to a variety of government agencies and private groups and individuals. There may often be complementary interests where particular changes in land management could generate outcomes valued by several different groups, or where the incremental cost of securing further benefits are low. For example, reversion of arable land may simultaneously reduce problems of diffuse pollution and enhance biodiversity. Modest levels of extra expenditure might then in addition secure public access. Small changes in what one group requires may have significant impact of the values of the outcomes to other groups. For example, reductions in diffuse pollution may arise irrespective of the location of the changes in land management, but the biodiversity interest may be favoured by a particular location. These potential synergies can only be explored through some sort of common planning process. The objective would be to set out relatively detailed plans for coherent local areas, such as Joint Character Areas, that would be more specific in terms of objectives and changes in land use and management at particular locations than is the case with current agri-environment plans.

Criteria

Impacts	Impacts depend on the extent to which any plans have impact in practice.
Precision	Potential to identify more efficient land uses and management changes by sharing information of objectives and trade-offs and further potential gains from polling resources too.
Transactions costs	Could be substantial. Commitment to a planning process would require engagement with the issues and a willingness to alter organisations' actions on the basis of the information revealed by the planning process. This implies a substantial time commitment and senior level representation.
Dynamic	Makes individual organisations less flexible in determining their own actions but could make the system as a whole more responsive to change.
Security	Presence of agreed plan probably increases security of improvements achieved.
Leverage	High: offers a forum where different stakeholder groups can explore the influence that they can make towards an overall objective.
Acceptability	Subject to the problems of increasing the general level of bureaucracy.

Scenarios

Managed	High values of land for both agricultural production and for conservation make the investment in planning more worthwhile.
Exploited	The high values of land for agricultural production and the limited funds available for agri-environment schemes make the investment in planning more worthwhile. But there may not be the funds available to undertake it.
Wildness	The lower pressures associated with agricultural production and the relatively well funded agri-environment policy may mean that there is less priority for precision in agri-environment schemes. But the potential to reallocate land towards new uses at large spatial scales indicates an important role for planning in bringing a full range of stakeholders together to allow this to take place.
Neglected	The limited funds for agri-environment schemes makes their allocation important, but it may be difficult to fund the planning process itself.

Contributions of innovations under alternative scenarios

This analysis suggests a large number of innovations that could make a contribution to the further development of agri-environment schemes. In principle each might be located in a more specific policy context and ways proposed in which they might be integrated and explored further. However, there are also important interrelationships between them; for example it is important to set out a clear plan for the development of habitat and biodiversity in advance of an identification of specific areas of land that might be targeted for acquisition. In the next chapter of the report, we therefore develop two potential approaches that draw on several of the innovations that have been explored in this chapter.

9. Two approaches for the future

Key options for the future

The research has identified a substantial number of possible agri-environment scheme innovations. Rather then seeking to pursue them individually, this chapter of the report draws out two more general approaches for the future development of agri-environment schemes, both of which draw on more than one of the potential innovations that have been identified so far. The first suggests the further development and rebalancing of the entry level scheme approach. This might be seen as a short to medium term policy option. The second looks at the potential for developing agri-environment schemes towards the production of a more resilient countryside. This would take a more local approach and draw together several of the elements that have been explored in the case studies. The second approach is less well refined the first, representing a sketching out of a process rather than a simple application of an innovation to a scheme. It would need to be the subject of further analysis and potentially of practical case study experiments before it could be implemented across the board.

Developing and rebalancing the entry level schemes

The introduction of entry level schemes represents a significant development in agri-environment policy. Entry level schemes have been introduced to offer simple and low cost access to agri-environment schemes to all farmers. These have generated considerable uptake across the UK. It seems likely that the transactions costs of the scheme are relatively low while at the same time including a wide range of possible land management options. Perhaps most importantly, they have established a flexible framework within which land management incentives may be altered across a broad scale and yet at a very detailed level.

But there are also some disadvantages from the point of view of an economic assessment. It makes it explicit that there is no duty on landholders to undertake the actions available as options within these schemes in that the state is now offering payment for undertaking them. This is a further challenge to the idea of stewardship in terms of a duty on landowners to forego maximum return in order to protect the environment. Also, the high degree of choice available to landholders gives a great deal of opportunity for them to commit to options that they would have undertaken anyway or that they can do at zero or minimal cost. As has been shown with regard to the Entry Level Scheme, this means that the options chosen are closely related to the agricultural context. But they may well not represent the options that would be regarded as maximising the environmental benefits or provision of public goods. Indeed, it would be a remarkable coincidence if they did. There are likely to be options selected in some circumstances that generate little environmental benefit. Perhaps because the actions would have been taken anyway, or because the production of management plans by farmers don't necessarily influence their actual behaviour. Alternatively, option selected may have little benefit because the outcome is of little relevance in that particular local context.

This is not to say that the approach adopted by the ELS is 'wrong'. There are advantages too in drawing large numbers of farmers into the scheme and in getting them to think and act in support of their whole farm environments. But it does suggest that there are likely to be

benefits from reviewing the options that have been selected against judgements as to the relative values of the alternative potential environmental impacts in different locations. It would be possible to offer regionally differentiated menus of options available and payment rates given (rates of points offered for particular options). These could seek to reflect more local priorities against the particular patterns of take-up that have been achieved. Regional priorities would be developed against Biodiversity Action Plan targets, requirements to meet the water quality standards for the water Framework Directive and actions that might act as a 'defence' against the future removal of a set-aside requirement under the CAP. The priorities might be put together within some sort of comprehensive rural environmental plan (see below) that could help to guide a wider range of agri-environmental decisions.

At the same time there are policy objectives to which a further developed broadly based scheme may make a distinct contribution. Two particular issues relate to the Water Framework Directive (WFD) and to set-aside. Work on the implementation of the WFD has identified significant areas of waters at risk of failing to achieve good status by 2015 as a result of diffuse source pollution from agriculture. This is represented, for instance in England by maps published on the Environment Agency website[11]. This implies that further actions will be required to address land management in order to meet the required standards.

The position with regard to diffuse pollution is likely to be worsened by the removal of set-aside. Research for Defra (Hodge *et al*., 2006) has indicated the potential contribution from set-aside in restraining levels of diffuse pollution, particularly from arable farming in intensively farmed river basins. Set-aside was included in the CAP as a supply control mechanism and became a major element of policy under the 1992 MacSharry reforms. However, the logic of full decoupling and the introduction of the Single Payment Scheme is inconsistent with a continuing requirement for a supply control policy mechanism. The primary goal of the CAP reforms is to allow the market price to determine land use decisions. While the position may be argued to be somewhat complicated by the continued tariff protection for certain agricultural commodities, it is UK government policy at least that this border protection should be phased out. Whether or not this is achieved will depend on EU policy decisions and this will depend on progress with the Doha or other international trade negotiations. However, it does seem very likely that set-aside will be removed from the CAP at some point in the not too distant future. The research for Defra argued that while the reasons for retaining set-aside as a supply control mechanisms are weak, there is a case based on its environmental impacts. Subsequent to the implementation of set-aside, it has become clear that it makes a positive contribution to the environment, both in terms of its impacts in mitigating levels of diffuse pollution and in support of biodiversity, especially with regard to farmland birds. These are both significant factors with regard to government environmental policy, as noted because of the WFD targets, but also because of the selection of the indicator of farmland birds as a government indicator of sustainable development. For these reasons, the report argued that, while there is uncertainty as to the extent to which the instrument is having a major impact on cereal production in present circumstances, that set-aside should be retained as a policy instrument on a temporary basis until such time as alternative policy mechanisms should be put in place. This clearly is of greater consequence to the extent that stronger commodity prices are renewing incentives for more intensive arable production.

[11] See: http://www.environment-agency.gov.uk/business/444217/444663/955573/1001324/1654756/1654908/1658110/?version=1&lang=_e

The key attribute of set-aside is that it covers a large area of land and removes land from production in the most intensively farmed areas. This differentiates it from any other agri-environment mechanisms. However, the framework established by the entry level schemes provides a context within which the environmental gains might be substituted. Clearly, in practice the control of diffuse pollution will depend on a mix of regulation, advice and education, and financial incentives. The first two elements are offered by Nitrate Vulnerable Zones regulations, and by the Catchment Sensitive Farming Initiatives. The further development of the entry level scheme approach has the potential to add the third element to the set of policies available.

This might be approached by altering the incentives offered for the options that can make the greatest contribution to the reduction of diffuse pollution within river basin areas that are at risk of failing to meet WFD standards. This might be in terms of the contracts offered to new entrants to the entry level schemes, although this may be seen as placing those who have entered the schemes earlier at a relative disadvantage compared with those who have delayed entry. Thus it may be preferable to offer an *entry-level top up scheme* that would allow landholders to sign up for extra options on the basis of a revised menu of options and points depending on the location of the holding. This would of course add administrative complexity to what is essentially a basic scheme. However, while it would be more complex from a government perspective, it need not necessarily appear so from the perspective of the landholder who only farms at a single location, where all they have to understand is the set of options available to them at that location. Landholders with land at more than one location might, of course, have to address more than one menu.

Of course, such a scheme could address more than just the problems of diffuse pollution. Indeed, given the uneven adoption of options under the present schemes, it would seem likely that there could be merit in extending the objectives to cover priority demands for other public goods, such as landscape or biodiversity within selected locations. An *entry-level top up scheme* could also be offered for disadvantaged upland and remote areas (a Less Favoured Area type top up) as an alternative to LFA schemes.

It would, further be possible to offer this type of top up on a competitive basis. The case studies cast some doubt on the extent to which savings may be achieved by means of a formal auction system, but it would be possible to develop an approach similar to that developed under the Conservation Reserve Programme in the United States. This could invite applications from landholders to participate in the scheme and assess their applications against some type of locally based environmental benefits index. This could include some weighting being given to landholders who indicate their willingness to enter the scheme at a lower level of compensation.

Research would be needed on a number of issues in order to evaluate this approach in more detail. It would be valuable and fairly straightforward to map the entry level uptake against the key policy objectives, such as water bodies at risk of failing to attain the WFD standard, at biodiversity priority areas or at areas of the most sensitive landscapes. This would indicate the extent to which simply rebalancing the options might make a contribution to environmental objectives. It would also be important to evaluate the alternative delivery mechanisms, the degree of spatial differentiation that might be appropriate and whether some sort of competitive element might be included.

Resilient countrysides

There are a number of factors that seem to make the present position different from that which has been the case with regard to previous reviews of agri-environment schemes, especially in terms of the uncertainty that will face the priorities for land uses in the coming years. Four extreme sets of circumstances have been characterised in the scenarios developed earlier in this report, but it is difficult at this stage to have confidence in which may turn out to be closer to reality in, say, 10-15 years time. This uncertainty relates both to the economic circumstances surrounding agricultural production activities depending on whether commodity prices continue to rise or move back towards the longer term declining trend, and to the potential implications of climate change that must create some element of uncertainty as to what sorts of public goods are looked for from particular areas of land.

This implies that agri-environment schemes should be developed in ways that can accommodate alternative outcomes. Perhaps the major threat to the agri-environment at the present time is to the gains that have been achieved over the past twenty years, both in terms of the physical gains to landscape and biodiversity on the ground and also in terms of the social capital in the form of the knowledge, skills and institutions that have been built up through the progress that has been made with the implementation of agri-environment schemes. This is not simply an 'end of contract' problem as discussed by Whitby (2000) where individual farmers may choose not to re-enter their land into an available agri-environment scheme, but more fundamentally the risk of an 'end of scheme' problem, where the government determines that it cannot afford to operate a substantial agri-environment policy at all because of the high cost relative to the political advantage that would be involved. If this is regarded as a serious possibility, there would be logic in allocating funds now in order to secure conservation benefits into the future that would otherwise be lost.

The discussion suggests that more should be done in the relatively short term to secure conservation gains, before the circumstances could change to prevent, or at least substantially raise its cost. This would imply a role for either land purchase or for conservation covenants. But long term acquisition of land or property rights clearly needs to be based on careful planning and targeting. And this will in turn require some degree of co-ordination of land management decisions across units greater than covered by typical agricultural holdings. There are a number of related elements in the innovations that have been discussed in this report that relate to the co-ordination of land uses across space and the targeting of priority sites.

Agri-environment schemes have the potential to provide a variety of public goods and so logically in determining the ways in which schemes should be implemented to best effect within particular localities, some method is required in order to recognise their aggregate value as recognised by different communities. While this might be undertaken by means of economic valuation techniques, it seems that both in principle and in practice there are reasons for believing that such methods may fail to reveal full or appropriate values. In this context, the objective is to create an institutional framework within which there is debate amongst those whose interests are affected and where incentives to the extent possible are consistent with broader social goals. This should in principle include both the gainers and the losers from potential schemes.

This would suggest a process at a relatively small scale. One possibility would be to use the Joint Character Areas (JCA) as identified in England. Work has already been done on developing Environmental Stewardship Targeting Statements for the JCAs and points are allocated to HLS applications for addressing key and secondary targets as defined in the targeting statements[12].

The options within these areas might be explored further through the use of 'opportunity mapping'. Saunders and Parfitt (2006) define this as 'broad-scale visions for change which offer a tool for identifying where environmental enhancement could be delivered on the ground, using existing areas of environmental value as a starting point' and record some 40 opportunity mapping initiatives of all kinds across England. This could be a collective, partnership approach to opportunity mapping and, as Saunders and Parfitt argue, should extend beyond the biodiversity sector to encompass landscape and the historic environment. The aim would be to take account of the full range of environmental values that might be promoted through the use of agri-environment schemes, including control of diffuse pollution, water management and resource protection and to involve a full range of interests in the process. This would thus have many similarities to the planning processes being initiated in the Danish case study.

This suggests the development of a more supportive and engaging local environment for the development of proposals for schemes on individual holdings. The level of support for individual landholders in preparing applications for entry into agri-environment schemes appears to be quite variable. In some localities there are active organisations, such as National Parks, that take on a significant role as facilitators. In Wales, the Tir Gofal scheme makes extensive use of project officers who are directly employed by the Environment and Countryside Dept. In England, the Catchment Sensitive Farming initiative has appointed project officers in all catchments, whose goals include influencing farmers to manage land in accordance with the aims of the WFD. In others there are no equivalent organisations. It is difficult to assess the extent to which the availability of facilitation impacts on the numbers, nature or qualities of applications that come forward for agri-environment schemes. However, it does seem likely that external support and a sharing of information and experience at a local level could have a significant impact on agri-environment applications and on subsequent scheme management. The experience with Dutch environmental co-operatives may offer one possible model of how a more cooperative environment might be promoted.

In fact, the experience with environmental co-operatives is not dissimilar from that of the Landcare movement in Australia and elsewhere. Landcare in Australia dates from 1986 when the approach was initiated between the state government and a farmers' organisation in South Australia. It has since become a major movement operating across Australia and internationally. Landcare is essentially a grassroots movement. Its primary contribution would seem to be in linking individuals and organisations at a local level, drawing attention and informing about the problems of land management and their potential solutions and in stimulating actions amongst landholders and other stakeholders. It is less about the development of formal collective contracts. Indeed, it has been suggested that its main achievement in twenty years has been in terms of community development rather than direct actions for land management.

[12] Details are at: http://www.defra.gov.uk/erdp/schemes/jca-ts/default.htm

There are various initiatives within the UK that have similar objectives that bear close relationships with the wider initiatives for integrated rural development. The most immediate comparator with the Australian experience seems to be with the Landcare partnership that operates five projects around the country[13]: the Test and Itchen, the Rother Valley, the Wensum, the Frome and the Hampshire Avon. The projects operated by the partnership aim to reduce the impact of agricultural run-off by raising the awareness amongst land managers of best farming practice. The partners include Defra, Environment Agency, Natural England and farm and conservation organisations.

It is perhaps not clear at this stage how best cooperative environments can be promoted, however Mills *et al*. (2006) recommend steps that should produce useful environmental cooperative (on the basis of a literature review and ten case studies). They are necessarily based at a grassroots level and will be likely to take on different characteristics in different contexts. Their success almost certainly relies on actions taken by particular individual 'social entrepreneurs' who are willing and able to stimulate action in their local areas. But such initiatives are likely to be promoted by the availability of grants to support individual participants relevant activities, this would seem to be provided already from current agri-environment schemes,

The much more active grassroots level activity in Australia as compared with the UK may be a reflection of the relatively more developed system of top-down agricultural and agri-environmental support in the UK. In its absence, more is required of local level organisations. In fact there would seem to be some degree of convergence between Australia and the UK in the extent to which Australia has been introducing a system of regional planning for land management initiatives and formal agri-environment schemes, while there is a development of more locally grounded approaches in parts of the UK.

This collective process would provide a context for both identifying critical sites that are central to different environmental objectives as well as signalling opportunities for groups of landholders, conservation groups and local authorities to collaborate in joint projects. The identification of critical sites would form the basis for some type of permanent conservation initiative, either by land purchase or preferably, should this type of instrument be available and appropriate, conservation covenant or burden. This could be funded through various sources, including agri-environment funds as the experience of the Netherlands would indicate is possible. Management of land purchased could be undertaken by a local conservation body (Conservation, Amenity and Recreation Trust). In the case of a covenant, the conservation body would 'take the benefit' and so take on responsibility for monitoring and enforcement. These activities require resources and this should be accounted for as part of the funding requirement.

It is also to be hoped that government agencies, particularly the Forestry Commission, and conservation organisations would take account of this sort of process with regard to their own resource allocation decisions.

Collective action might be supported through the type of local community action that operates under the Australian Landcare system. Indeed, many Landcare organisations in Australia were established in the context of this sort of collective resource management in the

[13] http://www.landcareuk.net/site/1.asp. See also: http://www.environment-agency.gov.uk/regions/southwest/315944/316002/426505/?version=1&lang=_e#

first place. But the planning and mapping process could also help to encourage bids for collective agri-environment contracts amongst groups of landholders with similar interests and common goals. However, it would be expected that the majority of contracts with landholders would remain as individual contracts under the HLS or equivalent.

Funding might be allocated towards agri-environment schemes within local areas from central sources depending on their importance with regard to national policy priorities, such as for BAP targets, PSA targets, such as for SSSIs, or for sustainable development indicators. These might be supplemented by regional or local authorities to the extent to which the land in the JCAs could support their own policy targets. There would also be the potential for contributions from conservation groups, businesses or even potentially from specific local charges where there are strong local interests in environmental conservation. This would need to be explored further from the experience of such schemes in Austria. This would apply particularly to areas with a strong tourist sector. The process could also stimulate collective thinking amongst local farmers about the potential for defining and marketing local brands of farm products.

This is clearly a relatively complex process and would require agreement for a wide range of stakeholders. The closest model that we are aware of is the Great Fen project[14]. It would be necessary to set out a programme for such a process and for the methods to be adopted prior to experimental schemes in some case study areas. The question is whether a more flexible approach towards the allocation of agri-environment funds might offer sufficient leverage to draw in landholders and others with a close interest as well as to draw in funds from other sources in order to bring this sort of process into reality.

[14] http://www.greatfen.org.uk/

10. Conclusions and recommendations

This is a significant time at which to be reviewing approaches towards agri-environment schemes. There have been major changes both in the way in which the CAP operates with the introduction of the Single Payment Scheme and in agri-environment schemes with the introduction of the entry level schemes in the UK. But at the same time, considerable uncertainty remains about the future. Agricultural policy remains under the doubts cast by world trade negotiations and the vagaries of the Doha round. But other trends could also be of major consequence, especially concerns for energy security and climate change leading to major investments in biofuels with potentially dramatic consequences for commodity prices and land uses. In terms of our scenarios, this leaves all of the four extremes as being possible and indicates a need to concentrate now on the actions that should be taken in the face of this uncertainty.

The sort of public goods derived from agri-environment schemes are highly valued by the British public, as evidenced by rural tourism, polls of top concerns, and media interest. There is however a lack of knowledge about precisely which public goods, or which bundles, the public would like to see supported in particular contexts. There is scope for further research in order to explore the priorities of the public for agri-environment spending. This should include polls, economic valuation and qualitative analysis (such as focus groups, citizens' juries, stakeholder consultations, and other democratic exercises). It will never produce definitive answers, but it will offer some indications of the strength of opinion and some guidance for the types of public goods that are appreciated. Even so, specialist knowledge of ecosystem functions, the potential implications of climate change and the types of investments that can help to build up the resilience of the countryside will also be necessary.

The case studies have demonstrated some of the ways that similar issues are being addressed in other countries. The main themes emerging form the case studies, such as co-ordinating decisions amongst farmers, securing conservation benefits by purchase of property rights, or of using more competitive allocation mechanisms are all issues that have been debated in the UK. There are in the case studies both indications of ways in which some problems may be addressed but also cautions that some approaches may not be so helpful. They also suggest a variety of innovations that are worthy of further consideration.

The question of the appropriate basis on which to calculate the level of payments in agri-environment schemes has not been resolved. The correct principle to follow is that the payment should reflect the full opportunity cost of the resources applied in delivering the required changes in land use and management. This is in effect the 'income foregone', but this does at least sound confusing where the activity to be encouraged makes a loss. Conceptually the question to ask is: "What is the minimum level of payment that would be necessary in order just to stimulate the desired changes to the way in which resources are used?" And this should be equivalent to the income that the resources could earn in their alternative uses. A more substantial issue arises where the underlying agricultural activity is itself not generally profitable. The calculations of income foregone are done on a partial accounting basis. Clearly compensating a farmer for a marginal change in income will not keep the business in activity if there is insufficient gross margin to cover the fixed costs. In this case the farm business as whole may not be viable and so compensation for the marginal change in income associated with entry into an agri-environment scheme will not make it so. Rather it may be necessary to provide a higher level of payment to take account of the fixed

costs associated with land management. The introduction of the Single Payment Scheme means that this is a more pressing circumstance than has been the case in the past. Where farming is fundamentally profitable, decoupling reduces the return to agricultural production and so reduces the costs of an agri-environment scheme that is seeking to reducing production intensity. However, it may also mean that the costs of certain production activities exceed the returns so that farmers may stop production. This will be an issue, where environmental objectives are dependent on the maintenance of agricultural production activities, and implies that higher levels of agri-environment scheme payment may be required. But much depends on which of the future scenarios we move towards. If the profitability of farming declines, then it will be increasingly important to find ways in which farm businesses may be made viable through agri-environment schemes. And this will depend considerably on the position of the whole farm household, not just the agricultural activities. In these circumstances there would be particular attraction to a tendering approach, but as we have seen, the prognosis for these is not straightforward (because farmers rapidly learn the maximum level to which they can, successfully, shade their bids). This is an issue that deserves further attention. If agriculture is profitable then the issue of income foregone is simpler conceptually and the conditions would be more similar to those that operated in the 1980s. More research should be undertaken into the costs of operating different types of business under different circumstances. This should include assessments of the economics of maintaining production, of extensifying production but meeting the requirements of agri-environments schemes, of stopping production but maintaining the land in Good Agricultural and Environmental Condition, and of abandoning production completely. An important element of this work will need to assess the levels of fixed costs under these different approaches.

There exist a wide range of possible innovations to the existing system of purchasing countryside public goods within the UK.. The ones with most potential are:

- Rebalancing entry level schemes
- Creating a co-operative environment
- Collective contracts
- Tendering for cost-effective purchasing
- Land purchase: long term and specialist management
- Regulation
- Alternative funding sources: markets and local funding
- Conservation covenants and burdens
- The production of agri-environment plans

It has not been possible to do more than highlight the essential attributes of these as potential innovations. Of the issues that we do not discuss further in this report, we would suggest that collective contracts, alternative funding sources and the potential for conservation covenants and burdens should be the subject of further research. Rather than seek to develop ideas here about the innovations on an individual basis, we develop two potential approaches for the further development of agri-environment schemes. One proposes the addition of an entry level top up scheme that can build on the framework established within the ELS and address issues of diffuse pollution and biodiversity. The other suggests a process for developing conservation plans at a local level and then of applying a battery of measures in an integrated way to build resilient and diverse local landscapes. The aim is to construct a more resilient countryside able to withstand future pressures.

The English Entry Level Scheme has had a significant take-up. Some 2.6 million hectares in England were covered by agreements representing nearly 30% of the farmed area by August 2006 (Welsh figures at the end of January 2006 were 3728 agreements covering 247,235 ha (15% of the Welsh agricultural area)).

This will have drawn new farmers into agri-environment schemes and provide a record of their whole farm environments. Quite what actual difference it will make to the quality of the rural environment in practice is less clear. It will be essential to monitor and publicise the ways in which the resources allocated to such schemes are making a positive impact. Decisions taken by farmers joining the scheme as to what options to take on within the ELS seem to be substantially governed by the agricultural conditions of their farm, suggesting that they reflect what is most closely associated with the local conditions, rather than the personal preferences of the individual landholders. But the ELS offers a framework within which to exert more influence over decisions in order to guide decisions towards actions that are the priorities for public policy. This gives an opportunity to target initiatives on adaptations necessary in light of forthcoming climate change, diffuse pollution problems or on areas of particular biodiversity pressures. The likely closure of the set-aside scheme creates an immediate requirement for some sort of scheme along these lines. It would be possible to develop an *entry level top-up scheme* which adopts a concern for a broad range of public goods by adopting an environmental benefits index approach, similar to that developed for the Conservation Reserve Programme in the USA. And this can also include an element of price competition by including an option for applicants to accept a lower rate of payment (thus permitting farmers to offer public goods at a lower price, if their costs are less than those specified under the scheme).

This is an issue for further consideration. Further work on the needs to be undertaken in various ways. It will be important to assess the changes in environmental management and in environmental quality that have followed as a result of the entry level schemes and to assess this against the objectives that we have for different rural areas. A particular issue will be the assessments of the risks of water basins failing to meet the standards required under the Water Framework Directive. This would form the basis for the development of priorities for a possible entry level top-up scheme. It would then be necessary to design the way in which the scheme should be implemented. One approach could be on the same basis as the existing scheme with standard options and fixed levels of points, albeit on a regionally differentiated basis. Alternatively, it could be on a more selective basis where applications were ranked against some 'environmental quality index', potentially including credit to applicants willing to participate at a lower level of payment. More work is required in order to flesh out the options that could be available.

As we have emphasised, there is great uncertainty with regard to the likely conditions for agricultural land use in the coming decades. It is plausible that agricultural returns may be higher than those witnessed in the preceding twenty years or yet they may return to the historic pattern of decline. The prospect of higher returns to agricultural land uses in future years is good for farmers who have faced an extended period of low returns across the whole range of agricultural commodities. But it will challenge moves to get more land into higher conservation uses and threaten the achievements that have been made since the mid 1980s. Committing land to permanent conservation uses either by acquisition or by covenants would provide a degree of security that is not otherwise available. But clearly before a decision on this is taken, much needs to be done to ensure that the permanent rights acquired are in the most appropriate location.

The second policy approach that is suggested brings together elements of conservation planning, co-ordinated action, entry of land into agri-environment schemes and permanent acquisition. This would start by stakeholder involvement at a local level; building on the work already done, in England at least on the Joint Character Areas. This would develop a planning process to represent the different interests in rural land use, from which would emerge information on the locations most critical to the provision of public goods into the future as well as the types and scales of changes in land uses and land management that would be of most value generally. This would in turn provide the framework within which agri-environment funds might be allocated so as to best advance the general interests of a local or national plan. It is hoped too that government agencies and NGOs, possibly with involvement of Local Action Groups financed under the EU LEADER program of the RDR, would also work together towards the mutually agreed goals. Long term security could be pursued through the allocation of funds towards the acquisition of property rights either in land or as covenants. Much of this could clearly be done within the existing legislative framework, although it may require changes to individual Rural Development Programmes so as to allow the allocation of funds for land purchase. Provision for NGOs to take the benefits of conservation covenants would need to be provided by legislation, although the equivalent may just be possible already in Scotland through the use of conservation burdens. This needs to be explored. The way forward at this stage to test the approach would be to identify some case study areas within which such an approach might be piloted. This might build on areas where research has already explored the options with stakeholders and farmers and where institutions may already exist for drawing stakeholders together. Possibilities might include areas such as the Fens, as noted above or the Upper Thames Tributaries area[15] or the Ythan Catchment[16]. It would then be necessary to draw information on the local environment together and to identify the objectives of government and non-governmental bodies as well as to survey the agricultural pressures and opportunities.

Further research

In the light of the general paucity of material on specific public demands (or what the public would like to see supported in particular contexts), there is scope for further research in order to explore the priorities of the public for agri-environment spending. This should include polls, economic valuation and qualitative analysis (such as focus groups, citizens' juries, stakeholder consultations, and other democratic exercises). Such research will never produce definitive answers, but it will offer some indications of the strength of opinion and some guidance for the types of public goods that are appreciated. Even so, specialist knowledge of ecosystem functions, the potential implications of climate change and the types of investments that can help to build up the resilience of the countryside will also be necessary.

As far as the experience with competitive tendering goes, the Australian case study sounds a note of caution. There do seem to be some potential benefits in the early stages, but less than had been anticipated. Coupled with the experience with tendering under the Conservation Reserve Program, this suggests that further research, including laboratory based work, would be desirable before there was any move into practical implementation of competitive tendering schemes. This should give attention to the potential for incorporating the potential

[15] http://www.wildcru.org/research/farming/UTP.htm

[16] http://www.ythan.org.uk/agri.htm

for reduced payments into an environmental quality index used for ranking applications for agri-environment schemes.

The drivers of agricultural land use, considered here, essentially determine the combination of financial incentives and legal constraints that govern choices of land uses. These discussions do, however, disregard the non-financial factors that influence landowners, such as the personal incentives or social expectations that may in practice also have an influence. We also ignore the transfer of land out of agriculture and into either urban use or forestry. While unconsidered factors, including non-financial incentives and transfers out of agriculture, are either difficult to measure or likely to represent a very small proportion of the land area, they are never-the-less issues for further research.

The principle of payment by results remains a good one. It would be useful exercise to draw together what experience there is available on experimental schemes that have adopted this approach.

Research would be needed on a number of issues in order to evaluate potential rebalancing of the ELS. It would be valuable and fairly straightforward to map the entry level uptake against the key policy objectives, such as water bodies at risk of failing to attain the WFD standard, against biodiversity priority areas, or against areas of the most sensitive landscapes. Similar analysis should be undertaken in the other countries in the UK. This would indicate the extent to which simply rebalancing the options might make a contribution to environmental objectives. Research would also be important to evaluate the alternative delivery mechanisms, the degree of spatial differentiation that might be appropriate and whether some sort of competitive element might be included. This would indicate whether or not an entry level top up scheme may be a priority. Work would then be required to explore alternative mechanisms whereby this could be introduced.

Our proposal for the development of resilient countrysides suggests a collective approach at a local level drawing landholders and other stakeholders together to develop and implement plans that can secure the conservation gains that have been achieved to date as well as co-ordinate land management decisions at a wider scale. The way forward here will be by means of more practical exploratory projects in case study areas.

There are of course many potential innovations that we have not discussed in any detail that should be the subject of further research. These would include:

- collective contracts,
- alternative funding sources,
- the potential for conservation covenants and burdens, and
- conservation offsets, where a requirement is established that conservation losses in one context must be compensated by conservation gains elsewhere

At this stage, work on these issues would first assemble the available evidence, analysis and experience before any fuller assessment of whether they offer potentially valuable innovations for the future development of agri-environment schemes.

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Annex I: Analysis of the ELS in England

The aim of this analysis was to describe: i) where, in England, various categories of ELS options (e.g. hedges; arable out of production; grassland; etc.) had been adopted; ii) how much money had been committed to these options; and also iii) to identify which characteristics of districts and their agriculture lead to greater uptake of the ELS.

For this purpose data were obtained for all ELS options with 'Live' agreements in ELS or ELS/HLS, (extracted from the Defra GENESIS GIS system on 4th August 2006. The compilations were carried out using NUTS4 boundaries, by Defra's RDS, National GI Unit, (Ref: GIU06-94). There were 22,644 'Live' agreements with ELS options at this time.

The units (m, ha, or trees) for each ELS agreement were then assigned to individual NUTS4 districts, using a random point on the mapped farm (agreement) area to determine in which district the points for that agreement fell. Thus errors from lack of spatial definition of individual ELS features were randomly distributed between districts - by taking all features for each agreement to be in a district determined by the location of a random point on the mapped ELS agreement. Once points for each option within all agreements had been assigned to districts, the figures were aggregated up to the district level by summing points for each option within districts. Counts were also made of the numbers of agreements with particular options agreed in each district.

Categorisation of ELS Options and National Totals

The categorisation of ELS options, used in this study, are shown in Tables A1.1 to A1.5, as well as the points assignment including allocation of points to categories for the combined hedge and ditch options. Figures A1.1 to A1.6 give the breakdown of options adopted within each of those categories - at the national level. As 30 points per hectare over the whole farm is paid at the rate of £30 per hectare one may assume that one ELS point amounts to a charge to the ELS of one pound. Thus it can be seen that enhanced hedgerow management could be taken to cost the ELS scheme 42 pence per metre of hedge per year. Similarly taking agricultural land out of production could be estimated to be costing around £300 to £400 per hectare per year.

The breakdown of national and government office region totals of points purchased to 4/8/06 is given in Table A1.7 and Figures A1.7 and A1.8. Thus boundary options account for the largest proportion of points purchased representing 36 per cent of the total. Intensive grass options account for the next largest proportion with 20 per cent, followed by management plans with 16 per cent, and arable out options with 13 per cent. Hedges alone account for 29 per cent of the total points bought (Table A1.7) (assuming one shares points equally between hedge and ditch for the combined hedge and ditch options).

The ELS options that accounted for most points purchased (Table 4.2 (Ch. 4 - above)) were Permanent Grassland with Low Inputs (EK2) with 10.9 million points bought and Hedgerow Management on both side of hedge with 10.1 million points bought, followed by other hedge options. The most widely adopted arable option was Over-Wintered Stubbles with 5.4

million points bought, followed by 6 metre Buffer Strips with 3.5 million points. Individual management plans also account for large numbers of points with Soil Management Plans and Nutrient Management Plans accounting for 5.1 and 3.6 million points respectively.

Table A1.1: Details of Hedge Options bought under the ELS

HEDGE OPTIONS	Points per m	Code
Hedgerow management (on both sides of hedge)	0.22	EB1
Hedgerow management (on one side of hedge)	0.11	EB2
Enhanced hedgerow management	0.42	EB3
Stone faced hedge bank management on both sides	0.16	EB4
Stone faced hedge bank management on one side	0.08	EB5
Combined hedge and ditch management (incorporating EB1) - shared	0.19	EB8
Combined hedge and ditch management (incorporating EB2) - shared	0.13	EB9
Combined hedge and ditch management (incorporating EB3) - shared	0.28	EB10

Table A1.2: Details of Ditch Options bought under the ELS

DITCH OPTIONS	Points per m	Code
Ditch management	0.24	EB6
Half ditch management	0.08	EB7
Combined hedge and ditch management (incorporating EB1) - shared	0.19	EB8
Combined hedge and ditch management (incorporating EB2) - shared	0.13	EB9
Combined hedge and ditch management (incorporating EB3) - shared	0.28	EB10

Table A1.3: Details of Options that take Arable Land Out of Production under the ELS

ARABLE TAKEN OUT OF PRODUCTION	Points per ha	Code
Take archaeological features out of cultivation	460	ED2
2m buffer strips on cultivated land	300	EE1
4m buffer strips on cultivated land	400	EE2
6m buffer strips on cultivated land	400	EE3
Field corner management	400	EF1
Wild bird seed mixture	450	EF2
Pollen + nectar flower mixture	450	EF4
Beetle banks	580	EF7
Unfertilised conservation headlands in cereal fields	330	EF10
6m Uncropped, cultivated margins on arable land	400	EF11

Table A1.4: Details of Management Plans Options bought under the ELS

MANAGEMENT PLANS	Points per ha	Code
Soil management plan	3	EM1
Nutrient management plan	2	EM2
Manure management plan	2	EM3
Crop protection management plan	2	EM4

Table A1.5: Details of Intensive Grass Options bought under the ELS

INTENSIVE GRASS OPTIONS	Points per ha	Code
2m buffer strips on intensive grassland	300	EE4
4m buffer strips on intensive grassland	400	EE5
6m buffer strips on intensive grassland	400	EE6
Buffering in-field ponds in improved grassland	400	EE7
Take field corners out of management	400	EK1
Permanent grassland with low inputs	85	EK2
Permanent grassland with very low inputs	150	EK3
Management of rush pastures (outside of LFA)	150	EK4

Table A1.6: Details of Less Favoured Area (LFA) Grass Options bought under the ELS

LFA GRASS OPTIONS	Points per ha	Code
Field corner management (LFA land)	100	EL1
Manage permanent in-bye grassland with low inputs	35	EL2
Manage in-bye pasture and meadows with very low inputs	60	EL3
Management of rush pastures (LFA land)	60	EL4
Enclosed rough grazing	35	EL5
Moorland and rough Grazing	5	EL6

Figure A1.1: Arable Out - Breakdown of options agreed

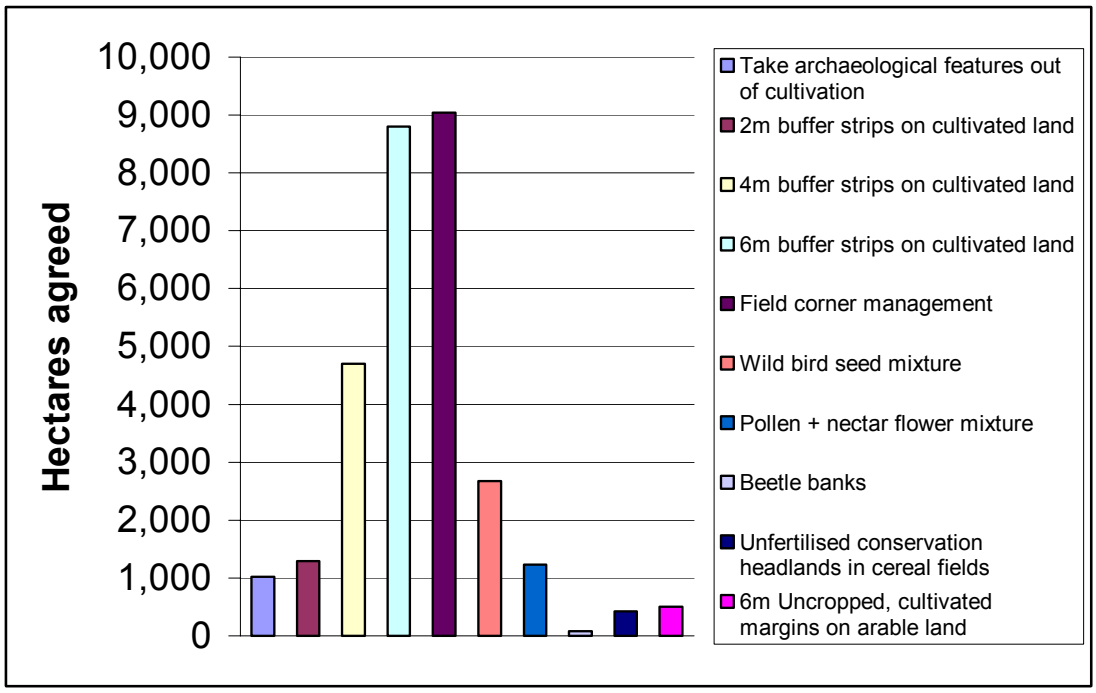


Figure A1.2: Management Plans - Breakdown of options agreed

Figure A1.3: Intensive Grass - Breakdown of Options Agreed

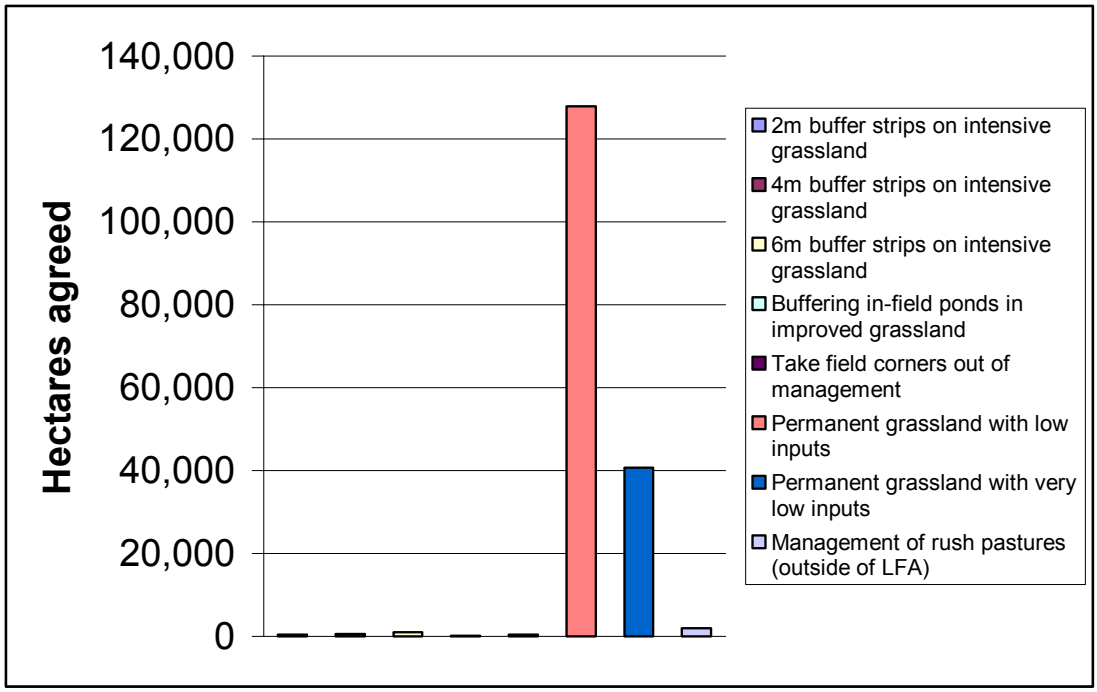


Figure A1.4: LFA Grass - Breakdown of options agreed

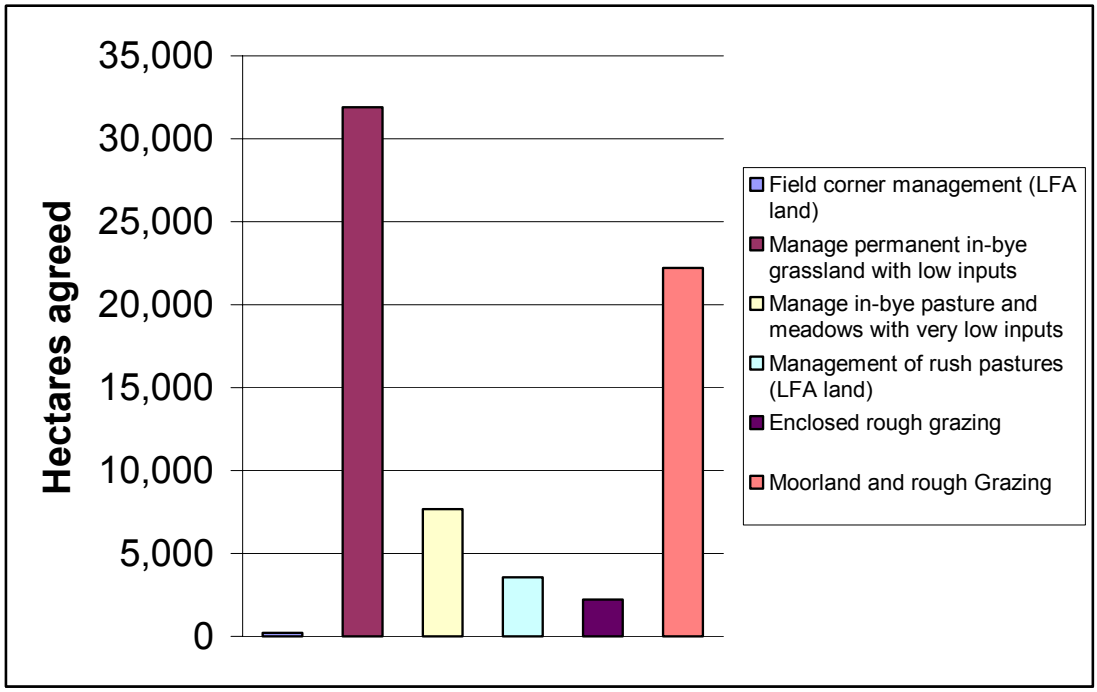


Figure A1.5: Hedge Options - Breakdown of options agreed

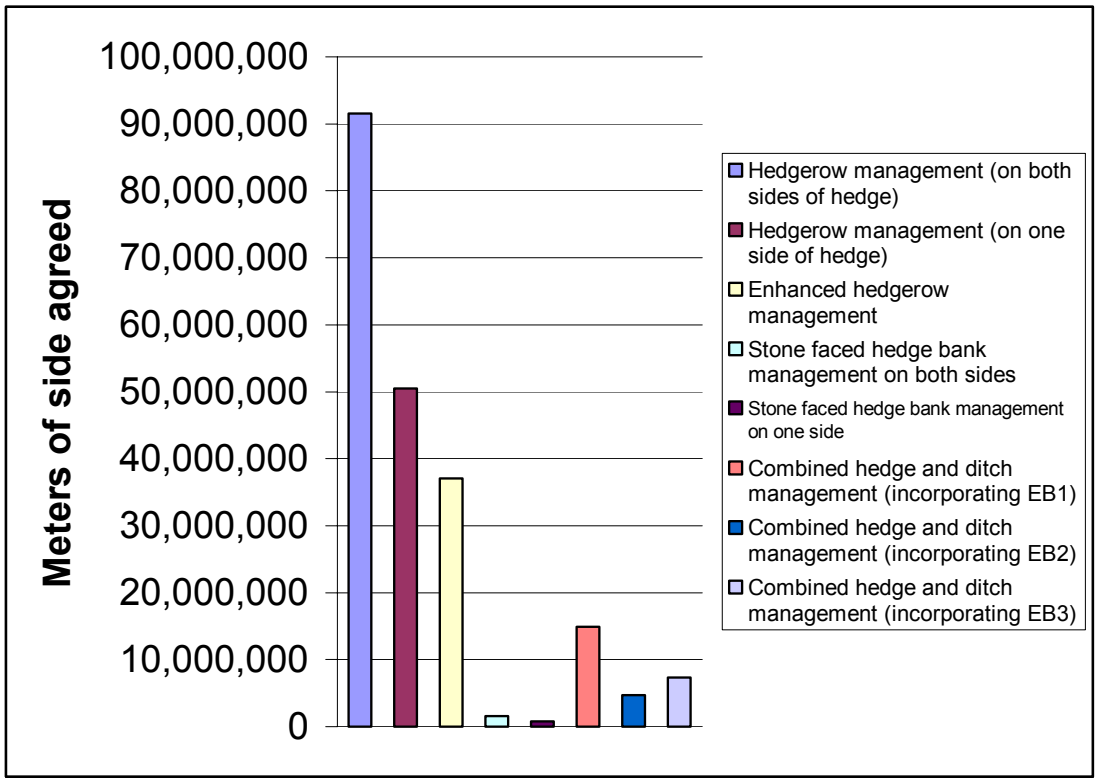


Figure A1.6: Ditch Options - Breakdown of options agreed

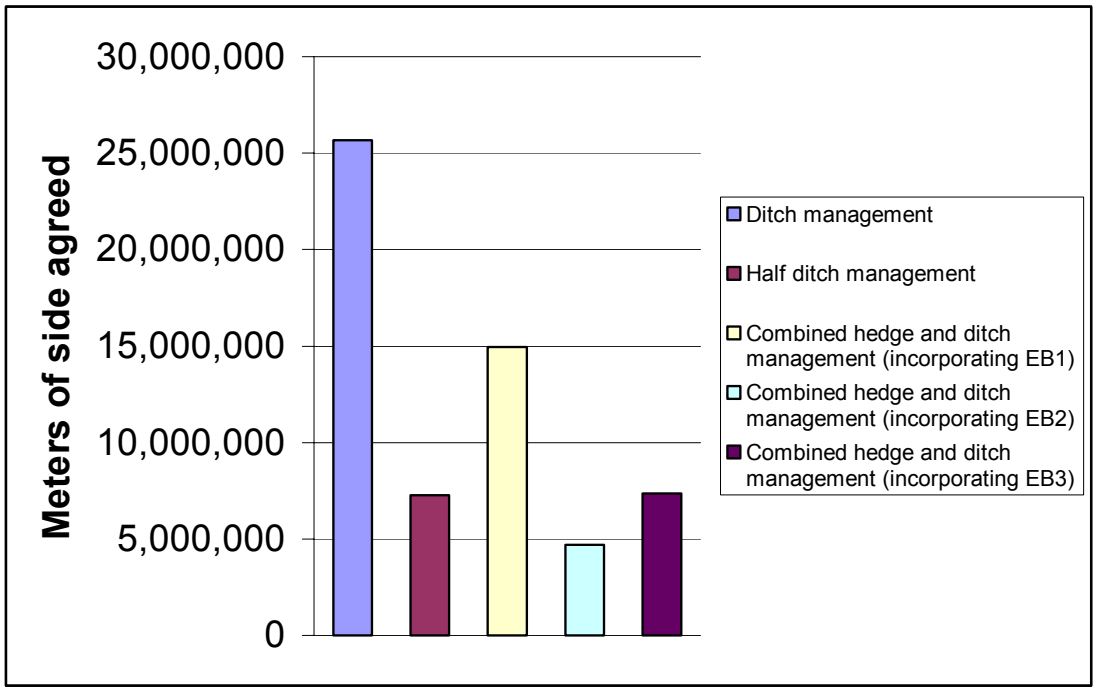


Table A1.7: Percentage of Points Bought in GORs and National Totals

Government Office Region	Hedges	Ditches	Arable Out of Production	Management Plans	Intensive Grass	LFA Grass
EAST MIDLANDS	32.8	11.3	15.6	19.0	13.9	0.4
EASTERN	28.2	14.4	21.4	20.3	8.3	0.0
LONDON	9.5	1.3	12.5	3.2	83.7	0.0
NORTH EAST	19.7	2.1	9.6	10.5	21.5	9.8
NORTH WEST	32.0	5.9	3.3	9.0	18.6	8.8
SOUTH EAST	22.8	4.7	17.1	17.2	26.8	0.1
SOUTH WEST	34.5	3.7	6.0	11.7	32.9	1.6
WEST MIDLANDS	30.0	4.0	8.5	15.6	29.2	1.8
YORKSHIRE AND THE HUMBER	26.9	4.4	13.6	17.7	13.7	3.9
England Total	29.0	7.3	13.2	16.2	19.8	2.2
					Accounted for here	88
					Actual Bought	100
					Other (%)	12.3

Figure A1.7: Total Points Purchased under the ELS by Category of Option.

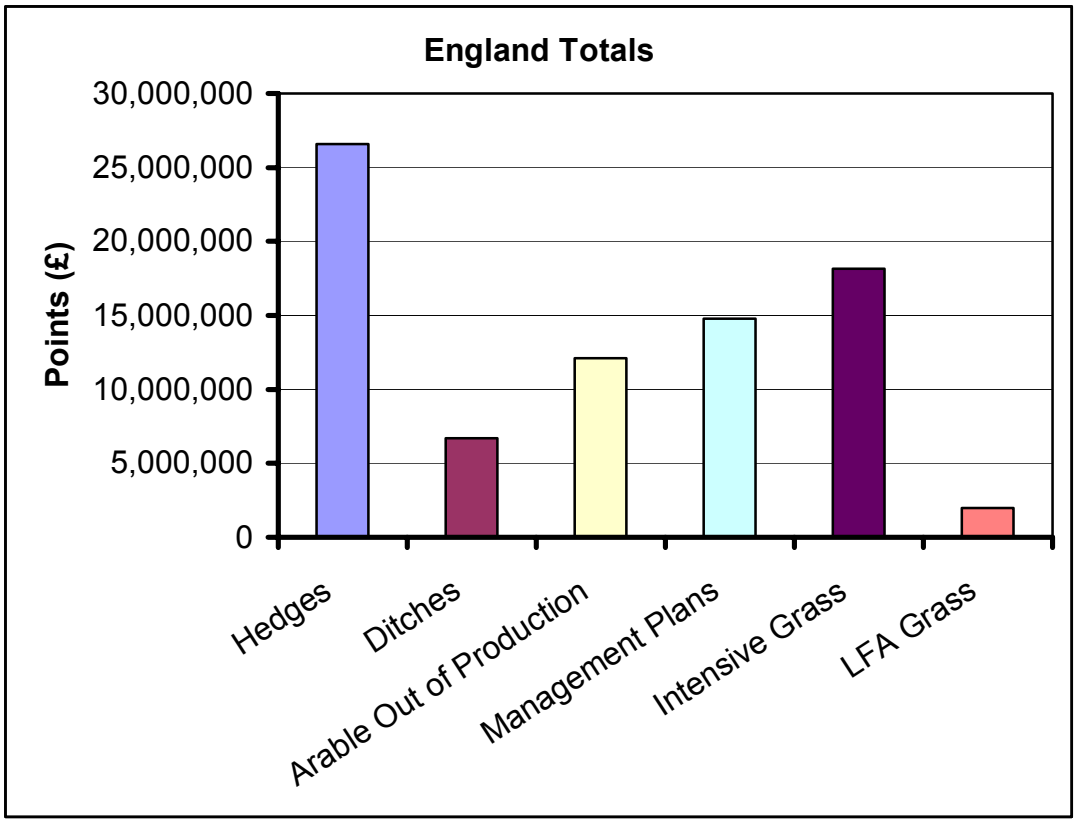
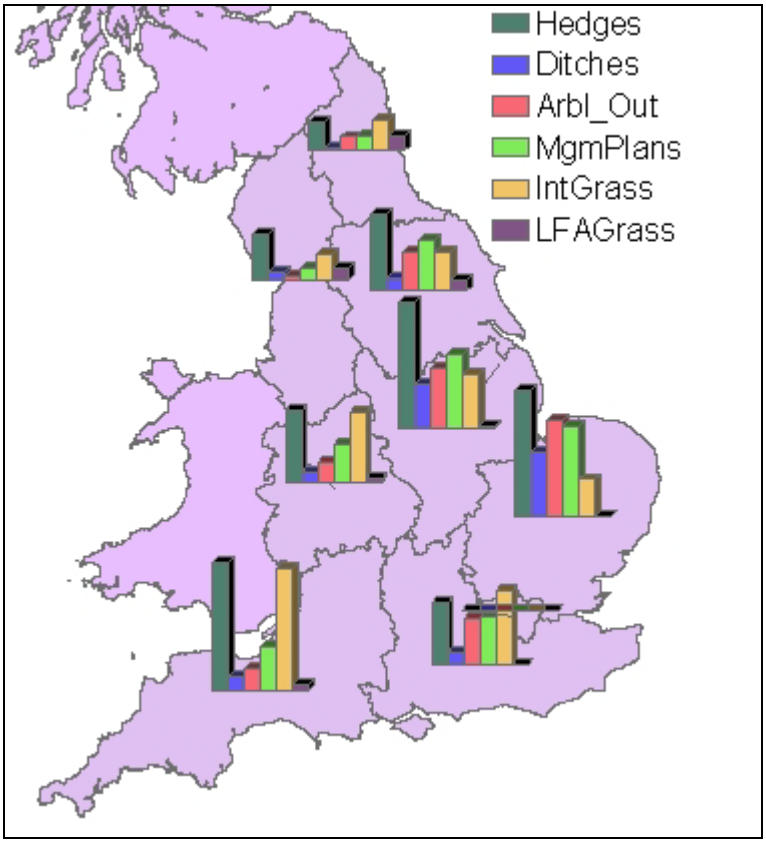


Figure A1.8: Points Bought by Categories and GOR



Detailed Uptake of ELS by Districts

Land entered into the ELS accounted for up to half the farmed area in some Unitary Authority or Local Authority Districts (UALADs - districts) (Fig. A1.9), with higher proportions tending to be in the eastern half of the country. This could be taken to indicate that uptake was mainly restricted to the more intensively arable parts of the country, with more boundaries in the less intensively farmed areas (Fig. A1.10).

Figure A1.9: ELS area as a percentage of the total farmed area, by districts..

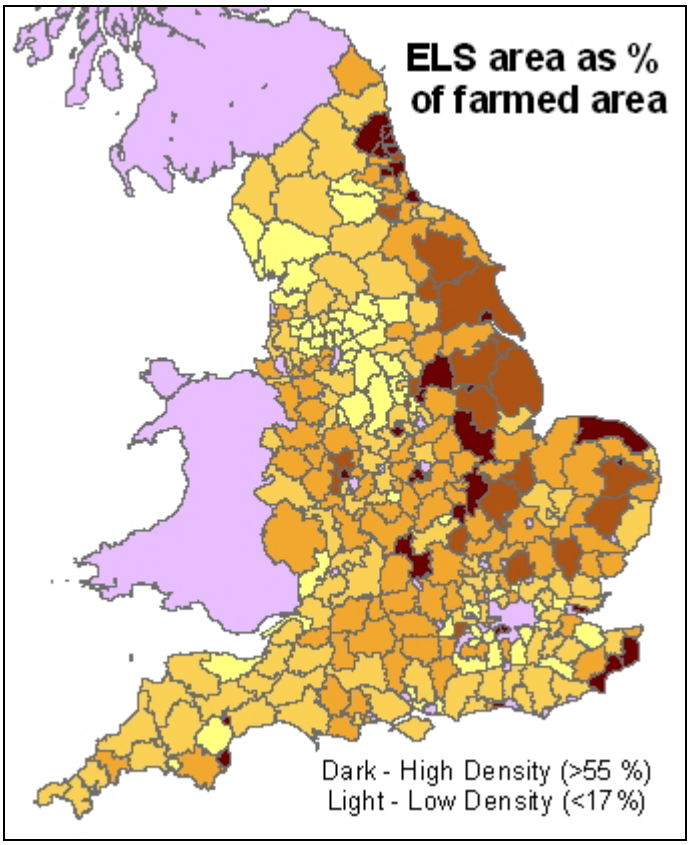
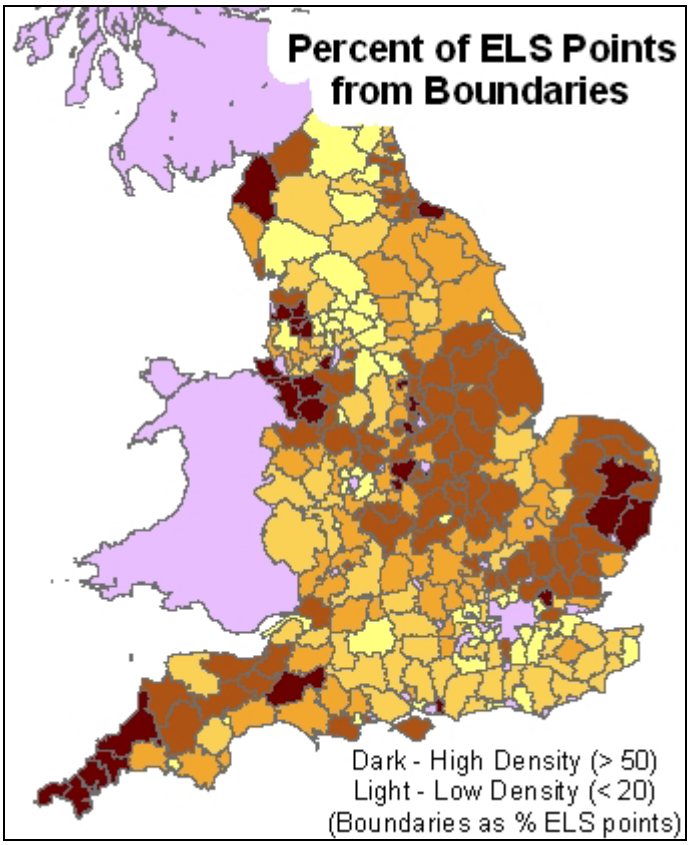


Figure A1.10: Percentage of ELS points in districts from boundary options.



ELS Hedges are concentrated in the East and West Midlands, with smaller concentrations in the South West, North East and East Anglia (Fig. A1.11), with greater than 2.5 km of hedge side per km² of district in these areas. Ditch options have mainly been adopted in the flatter districts of East Anglia and the East Midlands (Fig. A1.12), with over 1.8 km of ditch sides per km² of district in those districts. Accordingly boundaries account for the majority of ELS points purchased (greater than 50 %) in the North West, South West and the easternmost part of East Anglia (Fig. A1.10).

Figure A1.11: Density of ELS hedges - km of side of hedge per km² of district.

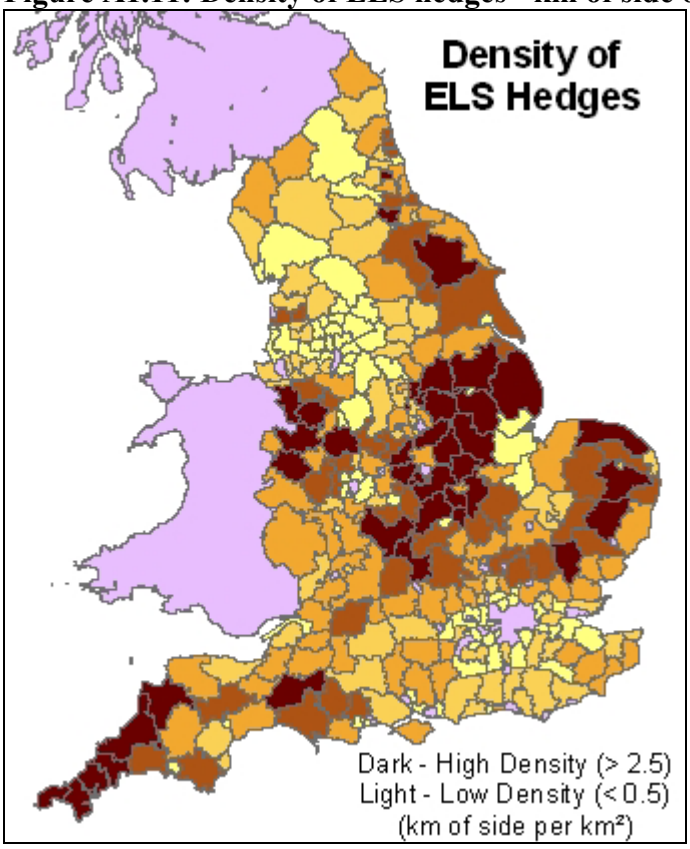
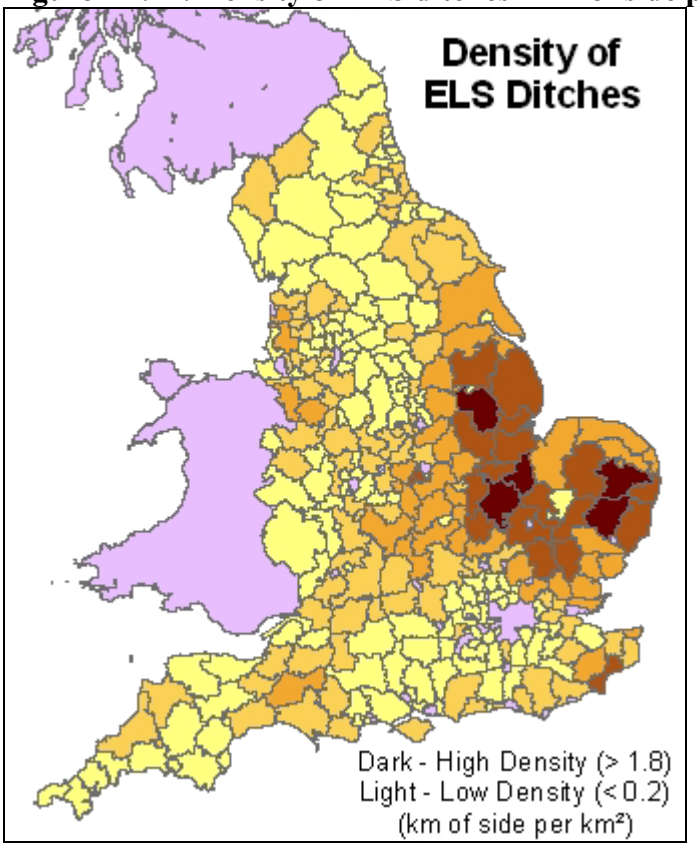
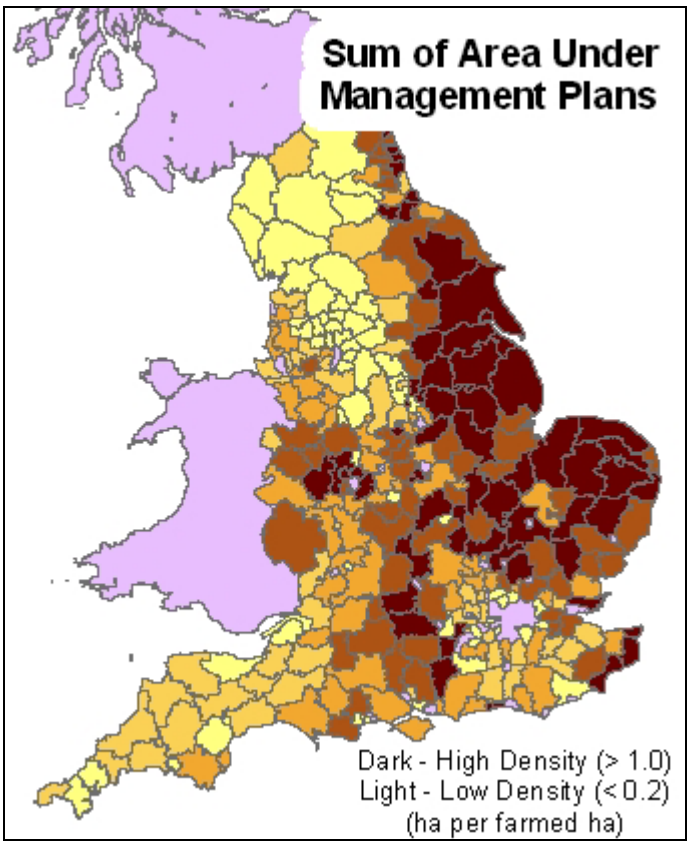


Figure A1.12: Density of ELS ditches - km of side per km² of district.



Management Plans under the ELS appear to have been concentrated in the primarily arable farming areas down the Eastern side of England, with a cluster of higher intensity in the districts around Wolverhampton (Fig. A1.13). There is also a band of higher uptake of management plans running to the North and South of Oxford (Fig. A1.13).

Figure A1.13: Sum of areas under ELS management plans - hectares per hectare total farmed area.



By contrast, Intensive Grass options under the ELS have the highest density in the West and North East, with another band of higher density running up the country between Guildford and Leicester (Fig. A1.14). LFA Grass options are almost all clustered in the North of England, with a few more in the South West and along the Welsh border (Fig. A1.15). However, even the highest densities of both Intensive Grass and LFA Grass options were only around 0.05 ha per ha of Total Farmed Area in the district, by 4/8/06.

Similarly for ELS options that take Arable Land Out of Production, the highest densities were only around 0.015 ha per ha of Cereals Area (or 1.5 per cent of the total area planted to cereals). As would be expected from the distribution of cereal farming, the Arable Out options are mainly in the East and South East (Fig. A1.16).

Figure A1.14: Density of ELS intensive grass options - hectares per hectare total farmed area.

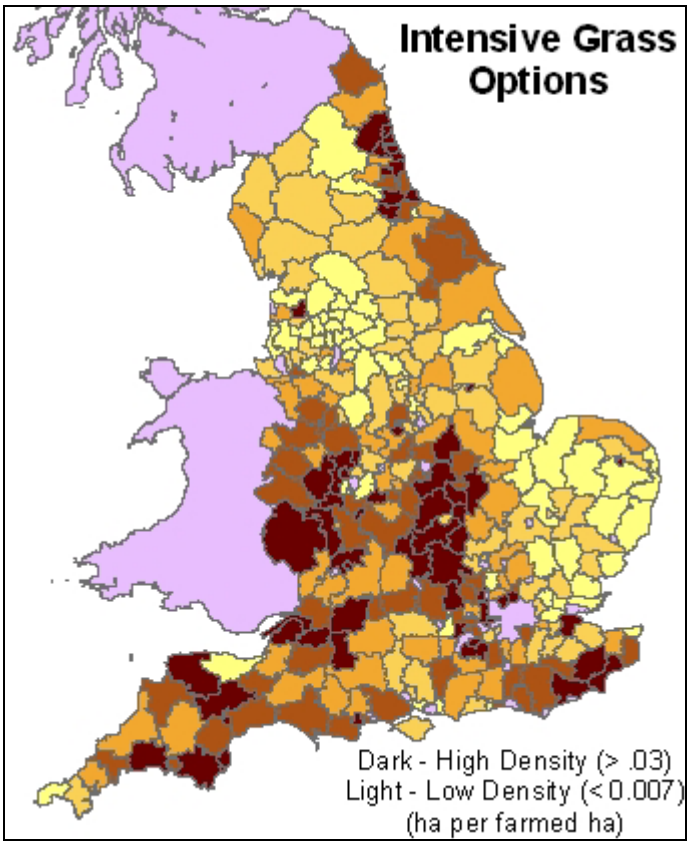


Figure A1.15: Density of FLS LFA Grass options - hectares per ha of total farmed area

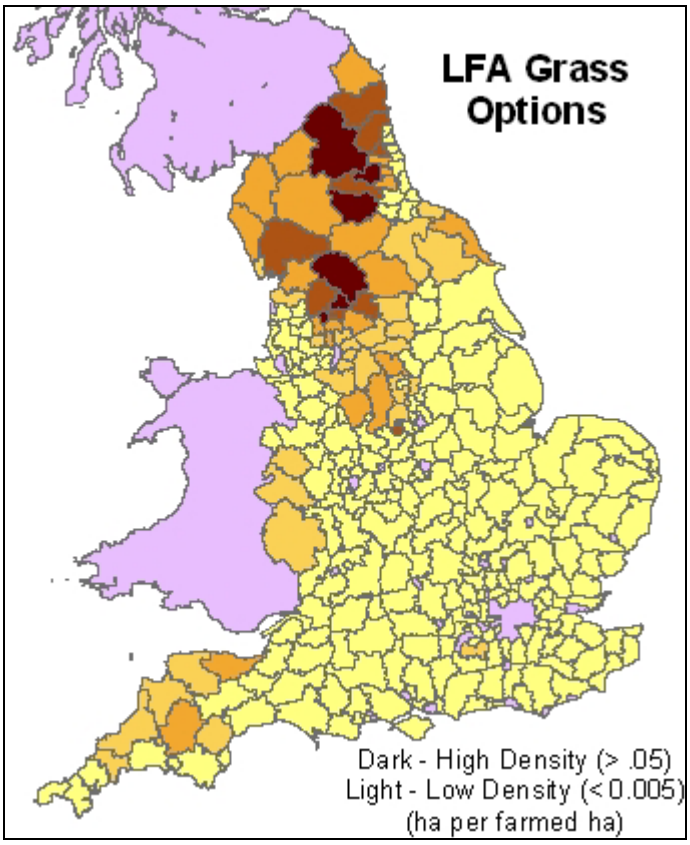
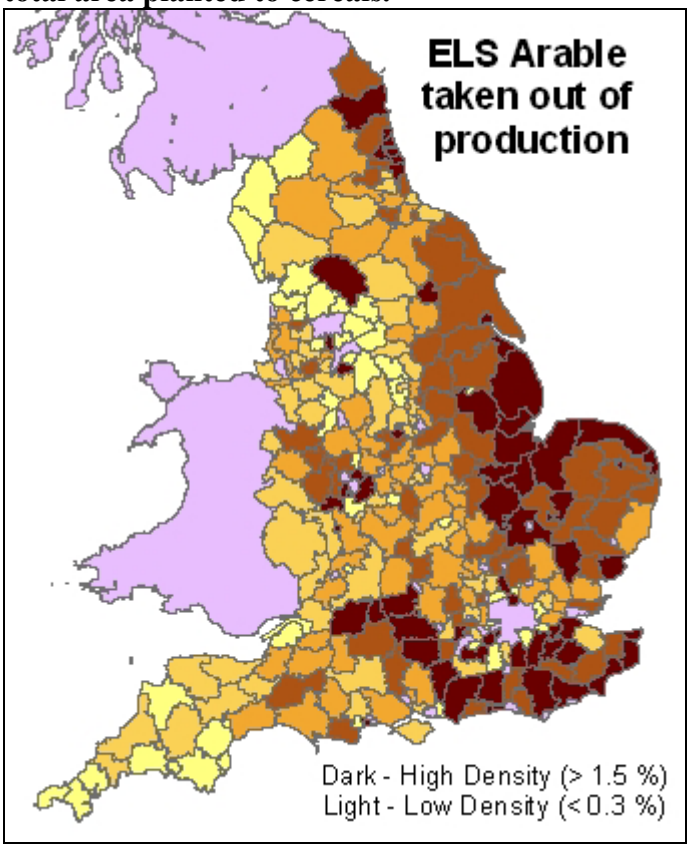


Figure A1.16: Arable land taken out of production by the ELS as a percentage of total area planted to cereals.



An OLS Regression Model of ELS Uptake in Districts

An analysis has been undertaken in order to assess the determinants of ELS uptake. A variety of potential influences were tested.

Data from the agricultural census from June 2004 for NUTS4 districts were downloaded from the Defra website. To estimate the Standard Gross Margin from ELS agriculture - excluding pigs and poultry - for each district, the areas and number of livestock for the classifications, given in Table A1.9, were multiplied by SGM coefficients adapted from Defra figures (Table A1.9). The individual totals were then summed to give an overall SGM (for ELS agriculture) for each NUTS4 district.

Table A1.9: Components of estimated Standard Gross Margin of ELS agriculture in district.

Enterprise	SGM £/ha
Cereals	850
Oilseed Rape	1050
Potatoes	5000
Sugar Beet	1750
Field Scale Vegetables	6500
Glasshouse	326000
Enterprise	**SGM £/head**
Dairy Cows	1250
Beef Cows	210
Breedherd replacements	120
Cattle < 1year old	140
Cattle 1 - 2 years old	140
Breed Ewes	47.5
Lambs < 1year old	1
Other Sheep	1

Adapted from Defra "Computing Standard Gross Margins"

The total number of Grazing Livestock Units per district was estimated using census data on livestock numbers for NUTS4 districts and the coefficients given in Table A1.10.

Table A1.10: Coefficients used to estimate the total number of Grazing Livestock Units (GLUs) in each district.

Livestock Classification	GLUs per head
Dairy Cows	1.00
Beef Cows	0.75
Breedherd replacements	0.70
Other cattle over 1 year number	0.70
Cattle < 1year old	0.34
Breed Ewes	0.10
Lambs < 1year old	0.04
Other Sheep	0.08

Derived from Defra Farm Business Survey

Uptake of ELS in each Unitary Authority or Local Authority District (districts) was assessed as the total area (ha) under ELS agreements on 4/8/06. This was modelled using ordinary least squares (OLS) regression, by fitting variables for the districts derived from: the 2004 June agricultural census; population variables for districts from the 2001 census (ONS 2004) (Table A1.11); as well as dummy variables for

clusters of similar districts (according to socio-economic criteria) derived by the Office for National Statistics from the 2001 census (Fig. A1.17 - ONS 2003) (Table A1.12); and dummy variables for Government Office Regions (GOR) (Table A1.12).

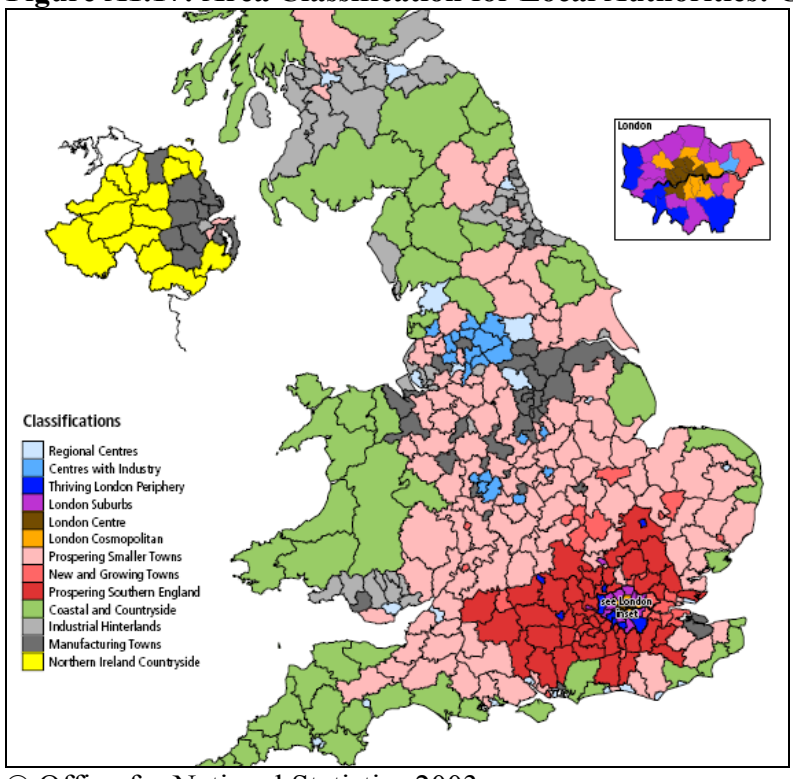
Table: A1.11: Relationship between various agricultural (2004) and census (2001) characteristics and ELS area - individual regressions.

Variable	r^2	coefficient	std error	t	p-value
Holdings of 5-to-50 ha (no.)	0.336	36.22	2.97	12.188	7.19E-28
Holdings >= 20 ha (no.)	0.610	39.62	1.85	21.378	1.55E-61
Total farmed area (ha)	0.831	0.37	0.01	37.807	4.3E-114
Cereals in district (ha)	0.861	0.99	0.02	42.398	2.5E-126
GLUs in district (no.)	0.239	0.28	0.03	9.617	3.5E-19
Dairy Cows in district (no.)	0.093	0.55	0.10	5.537	6.88E-08
Estd. Standard Gross Margin from agriculture excluding pigs and poultry.	0.800	0.00	0.00	34.093	1.8E-103
CSS and ESA	0.068	0.28	0.06	4.722	3.63E-06
Area of district (ha)	0.748	0.28	0.01	29.417	4.85E-89
Population density	0.225	-730.74	78.97	-9.254	4.95E-18
Two adult no children households (%)	0.264	3,124.51	304.38	10.265	2.72E-21
Weighted ave of ELS area in contiguous districts	0.174	0.51	0.06	7.887	6.36E-14
Weighted ave of ELS agreements in contiguous districts	0.126	63.49	9.67	6.563	2.43E-10
Dependant Variable:	EA1 --- ELS area in district agreed by 4/8/06 (ha)				

Table A1.12: Relationship between Office for National Statistics district clusters, and Government Office Regions, and ELS area.

Variable	r^2	coefficient	std error	t	p-value
ONS Cluster	0.180				1.18E-10
Regional Centres		-2,772	4,595	-0.603	0.546758
Centres with Industry		-3,461	3,823	-0.905	0.366152
Thriving London Periphery		-4,182	7,321	-0.571	0.568307
London Suburbs		-4,338	7,321	-0.592	0.554012
Prospering Smaller Towns		10,863	2,490	4.362	1.81E-05
New and Growing Towns		-784	3,823	-0.205	0.837702
Prospering Southern England		3,692	2,890	1.277	0.202479
Coastal and Countryside		12,673	2,890	4.385	1.64E-05
Industrial Hinterlands		-2,065	3,351	-0.616	0.538143
Manufacturing Towns		[Not used - cf dummy variables]			
GOR	0.077				
North East		-3,204	3,327	-0.963	0.336
North West		-7,006	2,834	-2.472	0.014
Yorkshire and the Humber		6,409	3,428	1.870	0.063
East Midlands		2,096	2,892	0.725	0.469
West Midlands		-1,479	3,037	-0.487	0.627
Eastern		3,399	2,852	1.192	0.234
London		-11,451	5,236	-2.187	0.030
South East		-4,641	2,661	-1.744	0.082
South West		[Not used - cf dummy variables]			

Figure A1.17: Area Classification for Local Authorities: Group (ONS 2003).



In the 'best' model 95.9 per cent of the variation in ELS area per district is explained by the following variables for each district: i) the area of cereals; ii) the total farmed area; iii) the sum of areas in the Countryside Stewardship Scheme (CSS) and Environmentally Sensitive Areas (ESAs); iv) the number of small (5 to 50 hectare) holdings; v) the number of Grazing Livestock Units (GLUs); vi) dummy variable for ONS "Coastal and Countryside" cluster (Fig. A1.17); vii) dummy for GOR "Yorkshire and the Humber"; viii) dummy for ONS "Prospering Southern England" cluster; and ix) District area - Table A1.13.

Table A1.13: Model explaining variation in ELS uptake (as area per district)

Variable	r^2	coefficient	std error	t	p-value
'Best' Model	0.959				
(Constant)		-729.29	302.58	-2.41	0.017
Cereals in District (ha)		0.63	0.05	11.821	0.000
Total Farmed Area (ha)		0.11	0.05	2.227	0.027
CSS and ESA area (ha)		-0.15	0.02	-7.318	0.000
Holdings of 5-to-50 ha (no.)		-7.70	1.47	-5.234	0.000
GLUs in District (no.)		0.09	0.03	3.712	0.000
ONS Cluster Dummy - "Coastal and Countryside"		1,432.49	515.17	2.781	0.006
GOR Dummy - "Yorkshire and the Humber"		-2,468.36	670.16	-3.683	0.000
ONS Cluster Dummy - "Prospering Southern England"		-1,255.07	473.16	-2.653	0.008
Area of district (ha)		0.07	0.03	2.609	0.010
Dependant Variable:	EA1 --- ELS area in district agreed by 4/8/06 (ha)				

ELS area in districts is highly correlated with the area of cereals. Districts with a greater farmed area also, logically, have greater uptake of ELS. By contrast the area in the district entered into CSS or ESA is negatively correlated with ELS area - because it is not possible to enter land into both ELS and CSS or ESA. Similarly, the number of smaller holdings (5 to 50 ha) in the district is also negatively correlated with ELS area. Smaller farms probably have less ELS uptake partly owing to the 'hassle factor' (the trouble of devising plans, maps and an agreement may not be seen as worth the trouble on small farms for only £30 per hectare). Also, small farms may tend to be more intensively farmed, which would mean there is less scope to adopt ELS options that limit production, and may have smaller amounts of ELS eligible features (e.g. hedges), as well has having a higher proportion of dairy farms.

The number of dairy cows per district was negatively correlated with ELS area in most models that included variables for farmed area (e.g. cereals, total farmed area, GLUs, etc) but did not include a variable for number of small farms (data not shown). However, when the number of holdings of 5 to 50 hectares was included in the analysis, which was also negatively correlated with ELS area, the variable for dairy cows dropped out. This reflects multicollinearity within the data, and probably the

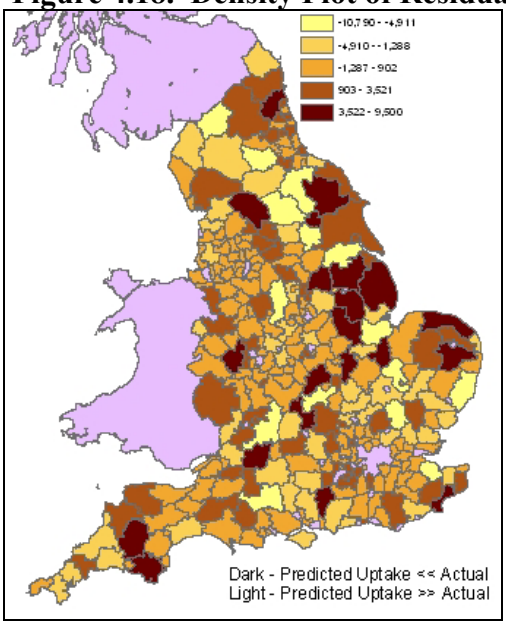
observation that, while dairy farms may tend to lack features for ELS options, most are also smaller and so when a variable was included for smaller farms, dairy cows ceased to be significant. The average dairy herd is around 93 cows at present in England (FAE 2006). This would suggest that the average dairy farm is around 50 ha, assuming a stocking rate of 2 cows per forage hectare.

The number of grazing livestock units in a district is, in this model, moderately correlated with ELS area. This is in contrast to the dairy cows variable which, though it had a weak positive correlation when regressed alone against ELS area, was negatively correlated in the models with variables for farmed area (owing to multicollinearity).

It was hypothesized that ELS uptake (as area in district) would be correlated with variables that reflect economic activity in the district - e.g. population density, ONS cluster, and two adult no children households. Thus when tested individually these explain small amounts of the variation (Tables A1.11, A1.12). However when the agricultural variables for the districts were included in the regressions these variables became non-significant ($p>.05$).

Spatially weighted variables for uptake in contiguous districts were constructed using a national matrix of districts, and the ELS uptake (area) figures for each district. Despite apparent clustering of residuals (Fig. A1.18), postulated to be due to spillover effects, the spatial variable explained, by itself, only 17 percent of the variance in ELS area ($p<.000$) (Table A1.11). When the other variables from the 'best' model were included in the analysis, the spatially weighted variable became non-significant ($p=0.5$), again reflecting multicollinearity. The lack of significance of the spatial variable in the presence of other variables suggests that the apparent clustering may be explained by similarities (which are picked up by the agricultural census variables) in contiguous districts. It is possible that this pattern of variation might be explained by a "spatial errors model" however, as the spatial variable explained so little of the variance, this was not explored further.

Figure 4.18. Density Plot of Residuals from 'best' model.



The Case Studies:

Annex II: **The Hedgerow Planting Scheme in Denmark - a case study of objectives, context, effects and implications.** By Anne Gravsholt Busck, Lone Søderkvist Kristensen and Jørgen Primdahl.

Annex III: **Nature Policy in the Netherlands: land purchase versus agri-environment schemes.** By Aris Gaaff and Marie-José Smits.

Annex IV: **The U.S. Conservation Reserve Program.** By Ralph E. Heimlich.

Annex V: **"BushTender" and "Auction for Landscape Recovery" case studies.** By Uwe Latacz-Lohmann.

Annex II: The Hedgerow Planting Scheme in Denmark - a case study of objectives, context, effects and implications. By Anne Gravsholt Busck, Lone Søderkvist Kristensen and Jørgen Primdahl.

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Introduction: A collective planting scheme with multiple objectives

Hedgerow planting has a long tradition in Denmark – dating back at least 300 years. Large projects of heath land reclamations in the 19th century on the sandy soils in Western and Northern Jutland created major problems with wind erosion, and clearly showed the necessity of shelterbelts. Although there had been some public subsidy for planting activities, the experiences of sandstorms lead to clear demands for action, with public support for planting schemes.

Today, wind erosion has become a limited problem – for agriculture and for the environment – with very few events of severe erosion or dust storms in recent decades. Still, with more than 600 km of hedgerows being planted each year in Denmark, it is an important landscape activity, affecting landscape structures and functions. Hedgerow planting with public funding has always had a bottom-up approach and is organised through a formal nationwide network, which encourages local coordination of the planting activity. The subsidy legislation, however, leaves flexibility regarding where, when and what to plant, and to what degree the planting activity is spatially coordinated.

Over time the scheme has had different objectives – starting out as a very broad planting scheme, narrowing down to the prevention of wind erosion in the late 19th century and first half of the 20th, and during the past three decades once again including multiple objectives such as habitat creation and improve of landscape aesthetics. In addition, the planting activities have been extended to the whole country including Zealand, which has loamy soils, and therefore limited risk for wind erosion.

The history of the Danish hedgerow planting and its public support

The history of the current hedgerow planting scheme goes back to the 1800s and has roots in the open, flat and wind exposed newly reclaimed agricultural areas in the western part of Denmark, dominated by sandy soils. Heath- and moorlands, which in the beginning of 1800s covered about a third of the western part of Denmark (Mid and Western Jutland), were during the next century reclaimed in order to: feed a growing population, compensate for loss of land to Germany during the 1864 war; and owing to some modern ideas of making the uncultivated landscape useful. Wind erosion as a consequence of the removal of vegetation cover was not a new phenomenon, but became a matter of increasing importance during the on going reclamation. Experiences and knowledge about plantings as an effective wind break existed (early agitation for the benefits of plantings is known from the 1700s) (Fritzbøger 2002), however, with the establishment of the Danish Land Development Service (DLDS) in

1866 the idea of establishment of shelter in connection to newly reclaimed agriculture land became more wide spread and implemented in practise. The DLDS was a private association established with the main purpose of advising and carrying out land development (heath land reclamation, drainage, soil improvements, and different planting activities).

From 1873 it became possible for the DLDS to support the shelterbelt planting financially through the distribution of plants (trees and shrubs) at much reduced prices or completely free. The funds, which made distribution of plants came from subscriptions of members of the DLDS (anybody could become a member), various donations and, from 1880 onwards, also Governmental support. The Governmental support quickly became the most important source of funds for the DLDS - a situation which lasted until the 1980s.

These initiatives promoted popular support to the shelterbelt planting idea and in the late 19th Century the first local planting associations were establishment, and in 1902 a national umbrella organisation was formed – named the Federation of Planting Associations (today the Danish Planting Association). The main purposes of the local planting associations were to agitate and give advice about hedgerow planting and to distribute plants among its members - either by support to farmers for the purchase of plants, or to buy up plants and distribute them. They also had to take care that newly planted hedgerows were properly maintained (Fritzbøger 2002). DLDS was the main promoter of the establishment of the local planting associations and they thus became closely related to the new planting association. DLDS was also given the right to appoint one member of the local board of the planting association. Over a period of one hundred years about 150 local planting associations were formed and they became the main framework for hedgerow planting in the western part of Denmark (Henningsen 1995, Fritzbøger 2002).

Related to the local planting associations, other types of sub-organisations were initiated – for example groups of members who mutually obligated each other to plant a certain amount of hedgerow at the same time within a specified geographical area. This idea of collective planting received increasing attention during the 1920s. A linking of hedgerow planting activities and public initiatives for combating unemployment under the depression in the 1930s (the creation of the 'flying squad') resulted in the creation of an enormous number of collective planting associations where hedgerow planting was organised and implemented in a joint process, in coherent geographical areas, and the work was carried out by the 'flying squad's. This collective organisation of the planting activity became the model for the post war organisation of, and support for, hedgerow planting in Denmark.

Over the entire period from the late 1800s until 1989 the DLDS was responsible for the technical, as well as the economic, support for shelterbelt planting with more or less continuous financial support from the Government, although this was provided through a variety of schemes. As mentioned above a specific Governmental support arrangement was implemented during the depression in the 1930s where governmental actions against unemployment were linked to the shelterbelt planting activities. This scheme included hiring unemployed people to undertake the planting of shelterbelts and small woodlands. The planting activity was financed by the Ministry of Social Affairs with the Ministry of Agriculture subsidising the plant

material. All the activities were organised and controlled by the DLDS. The arrangement lasted from 1938 to 1963 when it came to an end due to full employment (Knudsen 1983). In the period from the beginning of the 1960s until mid 1970s the Governmental support was limited, and was also undermined by an increasing inflation. At the same time there was a declining interest among land owners for the hedgerow planting activity as more emphasis was given to structural development (amalgamation of farmer properties and fields). This low level of interest remained until the mid 1980s (Fritzbøger 2002).

Revitalisation of the hedgerow scheme – from shelterbelt to hedgerow

The lack of public support and Denmark's membership of the EEC fostered the idea that the public support could be supplemented by funds from the EU Structural Fund (at this time Objective 5A funds). An application was approved and, from 1974, the EU co-financed hedgerow planting. In the first two years, only plantings in the western part of Denmark where there was a risk of wind erosion were supported. In 1976, however, EU agreed to support hedgerow planting in the entire country (Direktoratet for Fødevareerhverv 2005). From 1992 the EU co-financing was made available under Regulation 2080/1992 and, from 1999, under the Rural Development program article 33.

The increased funding resulted in a revitalization of the hedgerow planting, including a revival of the collective planting idea and the implementation of the first Hedgerow Planting Act (previously public support had only been authorised through an appropriation from the National budget). With the new legislation a distinction was made between collective plantings and individual ones, the latter being targeted to areas where it was not possible to participate in the collective measures because no local planting associations were established in the area. The support favoured collective planting considerably, because individual plantings only received support for plant materials whereas collective measures included subsidies for plant material and the plantings and subsequent maintenance for three years. This differentiation in support policy between the two types of plantings was maintained until 2002. After 2002 the two types of planting have enjoyed the same status concerning support (including support for maintenance) and farmers can apply for individual support whether a local planting association is established in the area or not (Direktoratet for Fødevareerhverv 2005).

Changing purpose of hedgerow planting over time

The purpose of the governmental support of the hedgerow plantings as well as the general purpose of the plantings has changed over time. In the first period from 1850 until 1930 the objective was shelter in a very broad sense, meaning shelter for farmhouses, gardens and fields and well-being in general. However, over time and by the increasing influence of the agricultural organisations the objectives became focused on agricultural production. There was no description of objectives in the first Hedgerow Act from 1976, but from the explanatory memorandum to the bill this narrow focus is clear. When the legislation was amended in 1988 a formal objective was inserted to: 'decrease the speed of the wind on areas, which is in use for agriculture and horticulture or is intended for agricultural or horticultural use in the future'. In the explanatory memorandum it is stated that hedgerow planting often has

positive side effects on the landscape. By amendments to the act in 1993, it became possible not only to support hedgerow planting but also to support the planting of smaller woodlots if these are connected to the hedgerows. The purpose of the act was then enlarged to include both increased shelter and benefit for nature and landscape ('promote hedgerow planting and supplementary planting to enhance the shelter effect and benefit for nature and landscape'). The objectives were further broadened in 2002 where also some aesthetic goals were included (Direktoratet for Fødevareerhverv 2005).

Plant material and design

The planting material and the design of the hedgerows have varied over time. The dominant hedgerow type planted in the period until 1960s was hedgerows in one row of trees, mainly *Picea glauca* or *Picea sitchensis*. However, a significant amount of hedgerows consisting of *Sorbus intermedia* was also established. Recognition of the low stability of these mono-specific type of hedgerows resulted in the research and design of new types of hedgerows as well as search for more sustainable planting materials. The new hedgerows consisted usually of 3 rows of trees, mainly comprising deciduous trees and shrubs. This type of hedgerow has dominated the planting activities until today. Since the 1990's, however, an increasing amount of hedgerow has been established as broader hedgerow (up to 7-8 rows). The requirements for specific plants to be used under the scheme have grown over time - both in terms of quality and share of indigenous species and Danish provenience.

The current hedgerow scheme – rationale and content

The hedgerow legislation falls under the policy domain of the Ministry of Food, Agriculture and Fisheries. The current hedgerow planting scheme is implemented through Act no. 571 of 17th May 2000 about support to Rural Development (to day replaced by Act no 1015 of 9th October 2006) and Ministerial Order no 1101 of 12th December 2002 about 'Support for shelter and biotope improving plantings' changed by Ministerial Order no 655 of 24th June 2004 and by Ministerial Order no 1317 of 14th December 2005.

The amount of funds allocated to the scheme is decided annually on the National budget. According to the Ministerial Order, the Danish Planting Association is responsible for the implementation of the support scheme, including making payments. However, the Directorate for Food, Fisheries and Agri-Business is responsible for the overall budget, the distribution of the budget among the different measures of the scheme, and physical verification of the hedgerows planted. The physical verification is done by the Danish Plant Directorate.

Penalties in cases where the condition of good agricultural practise is breached are handled by the Directorate for Food, Fisheries and Agri-Business. Other types of infringement of the condition for support are handled by Danish Planting Association.

Objectives of the current scheme

The objective of the ministerial Order 'Support for shelter and biotope improving plantings' is written in Article 2, which defines that: 'shelter and biotope improving plantings are plantings, which are established for the purpose of providing shelter to

agricultural land and/or to function as corridors in the landscape and increase the share of small biotopes on agricultural land'.
Article 1 describes the kind of planting activities eligible for support:
- new establishment,
- replacement of old out dated plantings and
- plantings surrounding technical installations and facilities

The latter kind indicates an even broader implicit objective, namely to include also aesthetic functions of plantings.

Persons and plantings eligible for support
Both farm owner and tenant farmers are eligible for support. The latter, however, only if the owner supplies written acceptance. Support cannot be given to plantings on land owned by a public authority.

The plantings, which may be subject to support, are defined as:

- Hedgerows with the following specifications: An adjoining collection of trees and shrubs consisting of at least 75 % deciduous species, in 1 to 7 rows and a width not exceeding 10 meters
- Small woodlots with the following specifications: A collection of trees and shrubs no larger than 0,5 ha or a width not exceeding 20 meters consisting of at least 75 % deciduous species

General conditions for the support
The planting activity must be finished before the ending of the third growing season, and the plantings should be maintained for at least 15 years. When deciding on the location of the hedgerows, other interests and values have to be considered to avoid conflicts, meaning that the general legislation relating to land use and land use changes in the countryside has to be obeyed.

Support level
The basic support level is 40 % of the cost of the basic eligible support activities, which are: Design, removal of old plantings, soil cultivation, plants from a specific list (quality approved species and provenience - only Danish provenience is allowed although dispensations may be given if no Danish plant material is available), weed removal and re-planting in case of dead trees during the first 3 growing seasons.

Since 2005, it has been possible to achieve 60 % support for the cost of basic eligible support activities. First, ploughing should be no deeper than local conditions allow (professional statement from local history museum is required). In addition, at least three of the following conditions should be met:

1. No use of pesticides during the establishment of the planting.
2. Establishment of an uncultivated fringe alongside the hedgerow – at least 1 metre wide. The fringe must be ploughed or moulded at least every second year.
3. In connection to the planting and on the adjacent fields, beetle banks may be established. They have to be at least 1 metre wide and 0.5 metre high and have the same length as the planting

4. The hedgerow must include at least three rows. For every 50 metres, 6 plants in an adjoining group should be left out, thus, holes in the hedgerow are required. This treatment will make variation in the hedgerow.
5. Establishment of a foot path alongside the hedgerow – allowing public access. The uncultivated fringe mentioned under no 3 and the beetle bank mentioned in no 4 may not be used for this purpose. A sign telling the public that entrance is allowed, must be established.
6. Only indigenous species is allowed. From 2009 an additional demand is that all planting materials must be of Danish provenience.

The organisation of the planting activity

As mentioned, the hedgerow planting may be supported through an individual or collective measure. Since 2002, the two measures have had equal conditions concerning the type of support. However, the collective plantings are still favoured because only approximately 12 % of the public subsidy is assigned for individual projects. Until 1988, the scheme was administered by the DLDS, but in 1989 this was handed over to the Danish Planting Association, the national umbrella organisation for the local planting associations. At the same occasion the monopoly of DLDS in relation to the technical support and planting of hedgerows was broken and other contractors were invited to bid on tenders to do the collective hedgerow planting (Fritzbøger 2002). Still, today DLDS remains responsible for planting and maintaining 90 % of all hedgerows planted with subsidies.

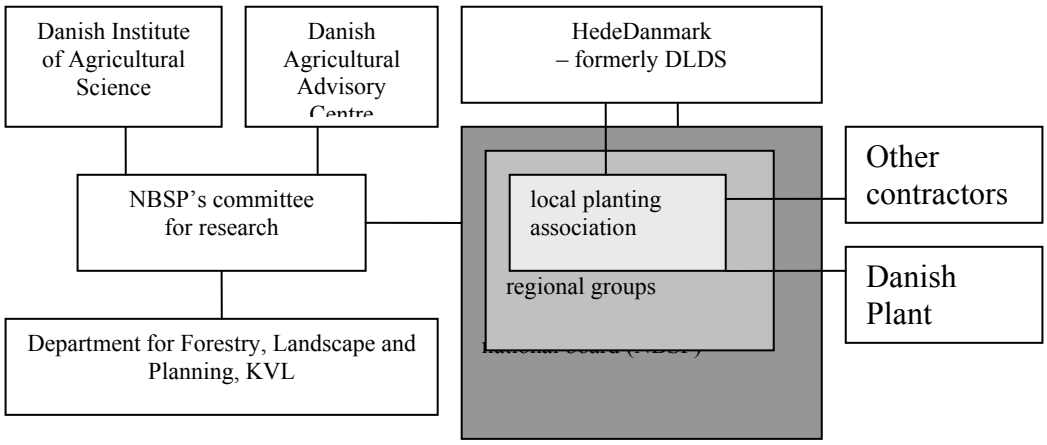
In 2002, the physical verification of the hedgerows planted was changed. Previously the Danish Planting Association was present every time a hedgerow was 'delivered' to the land owner after the three year maintenance contract with the professional entrepreneur. Here every hedgerow was checked – representing an informal physical control and subsequent corrections if necessary (Kvistgaard Consult 2003). From 2002 and on The Danish Plant Directorate, part of the Ministry of Food, Agriculture and Fisheries, is obliged to make a physical control of 5 % of the hedgerows.

Apart from the physical control, both the individual and the collective measures are administrated by the Danish Planting Association. The individual projects are administrated directly by the secretariat, whereas the collective projects are organised through so-called 'planting associations' consisting of farmers who choose to plant hedgerows in the same year within a specified local area. Each planting association is organised within a regional and national framework (Figure 1). The planting associations are connected to one of ten regional groups in Denmark, which are, in turn, represented in the National Board of Shelterbelt Planting (NBSP) (LDDP 2006). The Danish Planting Association is a private non-profit organisation, which administers the subsidy and is responsible for the implementation of the planting scheme and the proper use and distribution of public funds. In addition, the Danish Planting Association plays an important role as an interest group when the Ministry of Food, Agriculture and Fisheries develop subsidy schemes for hedgerow planting.

The Danish Planting Association has a committee for research, which coordinates the research conducted by the association. The committee includes members from research institutes and the national organisation for agricultural advisory service in Denmark (Figure 1). Until 2003, public subsidy for hedgerow planting included

funds for research (approx. 0.2 mio € / year). This funding, however, stopped in 2003, and therefore the committee has to look for research funding elsewhere.

Figure 1. Central actors in the network related to subsidised hedgerow planting in Denmark.



The collective planting activity is organised according to so-called 'planting rounds'. Using time-schedules made by the regional groups, it is decided in which year each local planting association may receive subsidies and thus plant hedgerows. The current distribution of funds allows each local planting association to initiate hedgerow planting approximately every seventh years. In the intervening periods, farmers have to apply for subsidies through the measures for individual hedgerow planting.

The forest management and landscape construction organisation, the former DLDS now named "HedeDanmark" is an important actor in relation to subsidised hedgerow planting. The organisation has been involved in aforestation and hedgerow planting since its founding in 1866. Until 1988, it was compulsory to use employees from the Danish Land Development Service as advisers and planting personnel for hedgerows subsidised through planting associations. In 1988, each individual planting association was asked to decide, which adviser and related planting personnel they wished to use. Until 2002, collective planting projects had to use an authorised adviser. Of 14 advisers 12 were associated with the DLDS, whereas two were related to the Forest Service, which is another large entrepreneur involved in plantings including hedgerows and aforestation. Today, there is no distinction between authorised and non authorised advisers, but most of the former authorised advisers are still central actors.

When a new round of planting is to start in a local area, an information campaign is initiated by the local planting association and the planting adviser. The adviser then collects the preferences of the individual farmers in a collective planting plan for the local area. The plan is formally approved by the executive committee of the local planting association and hereafter sent to the county administration for approval. The county officials may comment on any aspect of the plan (including possible impact on landscape character or various biological considerations), but most often restrict their

comments to legal issues, for example national requirements concerning distance from ancient monument (Busck 2003).

Based on research and experience and in close collaboration with the DLDS, the Danish Planting Association has developed a concept for establishment of hedgerows (Olesen 1979, Knudsen & Vestergaard 2001). The concept includes detailed guides concerning the design of hedgerows and technical instructions to follow when planting and maintaining hedgerows. A standard hedgerow includes approximately ten species of trees and shrubs, which are planted according to specified proportion and spatial distribution within each hedgerow. The Danish Planting Association and the DLDS recommends the concept, and this has ensured its nationwide adoption. However, the individual preferences of each farmer may influence the design of specific hedgerows, and adjustments can be made in collaboration with the local adviser. When adjusting the recommended design, farmers may choose trees and shrubs from a list of 50 species approved for subsidised hedgerows.

Planting activity and public support – developmental patterns and effects

As mentioned the planting activity during the early 20th century were predominantly made in the western and northern parts of Jutland. Figure 2a shows the cumulated planting activity in the period 1989 – 2005, and the pattern mentioned is still evident.

However, in recent years, the planting activity in Eastern Denmark is increasing in most parts (Figure 2b). The island of Bornholm (not shown) has a high proportion of forest and no tradition of hedger planting.

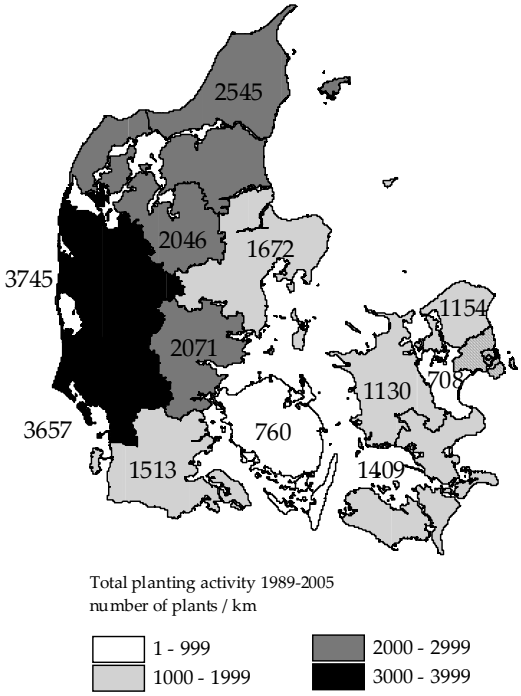


Figure 2a. The cumulated planting activity (based on data provided by the Danish Planting Association (DPA)).

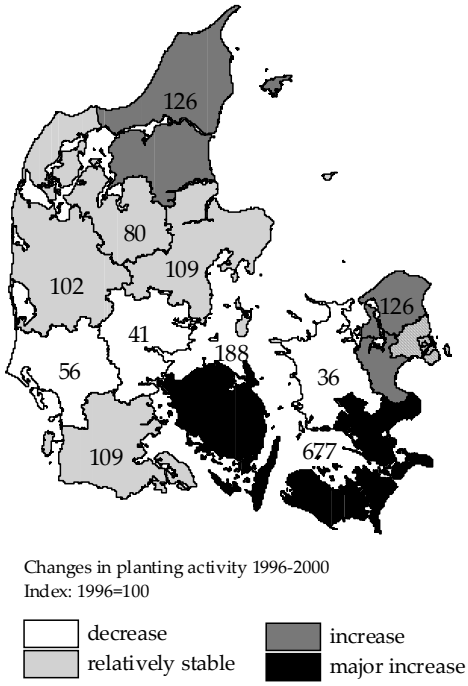


Figure 2b. The development of planting activities in Denmark, 1996-2000 (based on data provided by the Danish Planting Association (DPA)).

Until 2001, at least 1000 km hedgerows were planted annually through the planting scheme[17] (Table 1). In the period 1989 to 2000 the yearly budget for the planting scheme was raised from 18 mio DKK (2.5 mio €) to 36 mio DKK (4.9 mio €). Subsequently the planting increased from approximately 1000 km hedgerow / year to 1400 km / year – using up the total budget. Approximately 85 % of the hedgerows planted were planted through collective projects. The year 2001, however, was a very turbulent year for the planting activity as the scheme went through a major revision (for a time, total abandonment was expected) and ended up at a much lower overall budget (21 mio DKK - 2.8 mio €). At the same time the subsidy rate was lowered from 50-60 % to 40 % per cent and the distinction between individual and collective projects became less evident, as it is now possible to get subsidies for planting and maintaining hedgerows within both measures. During the period 1989 to 2005 the total funds provided have been used, but due to the changes in 2001, the total amount of hedgerows planted has decreased to 650 km / year in 2005 and the proportion of collective projects has decreased to 78 % (Table 1). In addition, the administrative costs of the scheme increased from 4 % to 8 % because of the 5 % external control, which was implemented in 2003.

Table 1. Funds and planting activities related to the scheme for hedgerow planting

Year	Funds	Collective projects	Admini-stration	Hedgerows planted
	mio €	per cent		km*
1989	2,5	87	4	1058
1990	3,0	88	3	1051
1991	3,0	88	3	1041
1992	3,1	82	3	1064
1993	3,2	82	4	785
1994	3,2	83	3	985
1995	3,8	84	4	1112
1996	3,8	82	4	1440
1997	3,8	85	4	1329
1998	4,9	88	3	1155
1999	4,9	88	3	1260
2000	4,9	88	3	1393
2001	2,8	88	5	1202
2002	2,7	82	6	521
2003	2,2	77	8	1010
2004	2,2	78	8	802
2005	2,2	78	8	653

Evaluation of the hedgerows planted

The increase in administration costs is mainly due to the formal physical verification of 5 % of the hedgerows introduced in 2002. In 2004, 239 hedgerows were controlled. The controlled plantings had received subsidy of 5.5 mio DKK (0.7 mio €). Of this approximately 2 % had to be paid back to the resort Ministry because of irregularities. The problems most often encountered were: hedgerows were included in a subsequent aforestation (this is not legal), hedgerows were too wide (becoming a small forest) or hedgerows with plants missing (pers. comm. Helge Knudsen 2006).

The general profitability of hedgerow planting has been analysed by the Ministry of Food, Agriculture and Fisheries in 2005 (Direktoratet for Fødevareerhverv 2005). It is concluded that both one rowed and three rowed hedgerows have a positive economic effect, whereas hedgerows consisting of 6-7 rows are not economically viable, because the extra shelter effect is minimal and does not counterbalance the extra cost related to extra area used and extra cost of planting and maintaining the hedgerow. It is, however, highlighted that the broad hedgerows (6-7 rows) have

[17] Only hedgerows planted by means of subsidy are recorded at the national level, but a number of hedgerows are also planted without subsidy. Case studies in different study areas in Denmark (Primdahl 1999, Kristensen et al. 2001) show that the length of hedgerows planted with and without subsidy, respectively, varies between regions. The proportion of hedgerows planted with subsidy may be high (75 per cent or more) in areas where hedgerow planting is an established tradition, and lower in areas where the planting tradition is relatively young (43 per cent) (Kristensen and Busck 2003).

improved potential as habitats. While the three rowed hedgerows (but not the hedgerows consisting of one row) may function as green landscape corridors, more rows are needed in order to function as a permanent habitat. This effect is not included in the calculations.

Overall, the framework for subsidised hedgerow planting has proven successful insofar as many hedgerows have been planted, and in general the hedgerows are well-grown and provide the intended sheltering function. Initiated by the National Board of Shelterbelt Planting, 21 hedgerows at different locations were surveyed in 1981 and once again in 1996 (Norrie 1997). Based on a detailed evaluation, Norrie (1997) recommends some adjustments to the composition of the standardised hedgerows, and draws attention to the importance of proper maintenance of the hedgerows. An extensive analysis within a study area in Eastern Jutland likewise shows that the maintenance is essential for the vitality of the hedgerows (Christensen & Primdahl 1999). The planting scheme provides maintenance for the first three years. This is crucial for the establishment of the hedgerow. Indeed, this knowledge was part of the argumentation for including maintenance in the measure for individual plantings in 2002. However, later it is necessary to e.g. cut nurse threes (e.g. Populus), which otherwise will shadow out the lasting threes (e.g. Oak (Quercus) and Beech (Fagus)). Lack of thinnings have proved to be a problem in some hedgerows.

Most evaluations give emphasis to the vitality of the hedgerows and of each tree or shrub species within the hedgerow. The hedgerows are not evaluated in their spatial context, and the use of standardised hedgerows nationwide is not questioned. In recent years, however, criticism has been aimed at the use of such standardised designs when establishing landscape elements. Hansen-Møller (1991) draws attention to the possible erasure of regional landscape identity in relation to the standardisation of fringe composition of newly planted woods. The same point is raised by Højring (2000) in relation to hedgerow design. In addition, it is questioned if hedgerows are always positive – e.g. if planted in landscapes, which are relative, open hedgerows may block the open views.

Busck (2003) has analysed the relationships between actors in the network of subsidised hedgerow planting. It was found that the institutionalised network and high level of professionalisation may lead to standardisation of hedgerow designs and a lack of attention to coordination of hedgerow location and design at a local or regional level in order to contribute to landscape values reaching across property boarders. In local areas, where the collective planting activity has become a matter of routine, the collective plan is usually nothing but an aggregation of individual property plans. Thus, the plantings are not genuinely coordinated at the local level – and thereby not exploring the landscape potentials of a coordinated planting activity. Central to the stability of the present planting practice is the immediate success of the activity, the high degree of professionalism and a division of labour between local actors, where farmers and adviser perceive themselves as experts on placement and composition, respectively, and do not question this practice.

Major implications and lessons to be learned

Few current schemes have had greater and more long lasting effects on Danish agricultural landscapes than does the different hedgerow planting schemes

implemented over time. On the sandy soils in Western and Northern Jutland the scheme has reduced problems related to wind erosion from constituting a major ecological problem in the 18th and 19th Century (Kjærgård 1991, Aslyng 1968) to being a limited problem – for agriculture and for the environment – with very few events of severe erosion or dust storms in recent decades. The plantings have also (as a cumulative effect of all the individual hedgerows) changed the meso and micro climate, especially in Jutland, by reducing the overall wind speeds and thus increasing crop yields (Aslyng 1968).

As described the scheme has broadened in recent decades to include other goals than the prevention of soil erosion and improvement of the water balance and crop yields. The scheme has changed from a shelter belt scheme to a broader "hedgerow scheme", in which habitat creation and landscape aesthetic goals have been included as scheme objectives (directly or indirectly). In addition, the planting activities have been extended to the whole country including New Zealand, which has loamy soils, and therefore less potential for wind erosion.

In terms of institutional design the scheme has always had a bottom-up approach and a collaborative element. Thus, the collective plantings are initiated and administrated by the Danish Planting Association and has for a number of years been the most important measure in the scheme. The bottom-up and collaborative aspects were common for Danish subsidies related to agricultural expansion in the late 19th and early 20th century but in the last decades subsidies for agriculture have become more top-down oriented and targeted towards single farms – leaving the hedgerow planting scheme as very unique.

We find that the collective dimension has four advantages compared to measures targeting single farm agreements. First, collective hedgerow plantings make the planting process and subsequent maintenance more efficient because the purchase of plants and the use of machinery for plantings and maintenance for the first three years can be done on a large scale – lowering the expenses in comparison to single individual hedgerows. In addition, choice of contractor (for planting and maintenance) is done for the whole collective project and thereby it may be possible to negotiate a better price for the owner.

Second, since the scheme is run by the non-profit Danish Planting Association, transactions costs (measured as administrative costs and controls paid for through the public budget) are low – approximately 8 % of the total budget.

Third, the collective approach allows for coordinating the plantings within a local area through a 'planting plan'. Historically, this has been a necessity in order to combat wind erosion, but may also be used for other purposes. Today the planting plan is sent to the county administration where it is checked for discrepancies with protected habitats and other designations and legal rules.

Finally, a fourth benefit is related to the professional and learning dimension in the scheme. Since collective planting projects are usually initiated and implemented in a process involving local meetings, advising and manual work done by specialised enterprises, a professional culture has to some degree evolved in relation to the scheme.

The professionalisation and immediate success has, however, implied that the overall productivist paradigm (targeting soil conservation and yield increase) of the planting activity only recently has been questioned. In recent years, however, the current planting practise has been contested in various ways.

First, the dimensions of added potentials of the collective measure have not been well developed. The planting plan for example is often just the result of many individual hedgerow projects within a local area. The plan has very seldom been used constructively - for example to form landscape corridors between two existing forests; supporting cultural-historical patterns, support common aesthetic functions or to link public objectives within nature conservation with the hedgerow planting. The Danish Planting Association is aware of this 'missed opportunity' and has taken the initiative to introduce so-called collective landscape plans. This will be briefly described in section 8.

Second, the scheme has been criticised for being based on rather simplistic standard models for species composition and the plantings – individual and collective alike - are rarely linked to the specific landscape character of the local area in question.

Third, the species composition is criticised for containing too many non-native species and, although the list of species and varieties approved for the plantings has changed several times, it is still being contested.

Fourth, the lack of specific adaptation to the landscape character and the sometimes in an insensitive way the hedgerow are planted has in similar ways been criticized over the years. Many examples of hedgerows being planted to replace (and after removal of) stonewalls and hedgerows being planted in odd patterns spoiling for instance the very characteristic star shaped field patterns around many villages. Such practices have, however, becoming more rare in recent years.

In sum, the Danish hedgerow schemes implemented over a long time span have indeed transformed the Danish agricultural landscapes and have in general been viewed as beneficial to the landscape quality from various points of views. At the same time it is also clear that the former successes in stopping erosion and increasing yields have made it difficult for the planting associations to develop the schemes to serve an expanded set of functions. Finally, it should be stressed that the current scheme represents the only remnant of former schemes within agriculture, which are based on collaboration at a local level and on collective actions for new, improved, landscapes. We therefore believe that the collective hedgerow scheme has a great potential in the future if it is able to develop and adapt to new demands for a multifunctional landscape.

Perspectives and potentials

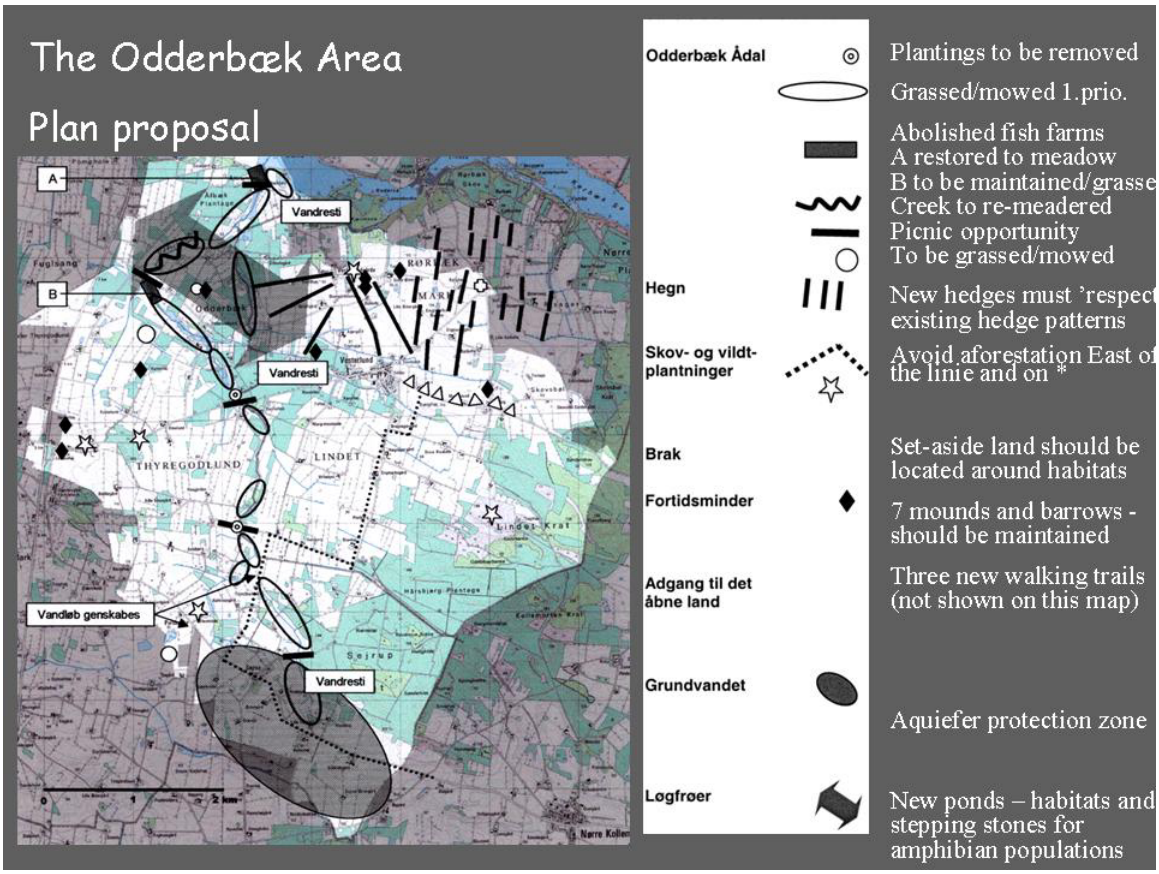
Few years ago the Danish Planting Association took the initiative to develop a new type of scheme – called 'collective nature plans' in a direct translation (collective landscape plans may be a better translation). The initiative was partly an attempt to use and enlarge the potential advantages of the collective hedgerow plantings, partly a response to new ideas of 'nature plans' made individually for each farm. Since the experiences with collective landscape plans have been widely discussed in Denmark

and are being considered for introduction as a scheme under the rural development programme, we will outline this idea.

Basically, the idea behind Danish Planting Association's initiative was to expand the notion and institutional framework of collective hedgerow plantings to agricultural landscape management in general. Instead of a local planting association a collective landscape planning association shall be formed (or an existing local, broad organisation should function as the platform) and shall initiate and lead a process of landscape planning - resulting in a comprehensive plan for a local area. The local area would typically be a parish, an area from 1,000 to 5,000 ha usually containing one or two villages and around 100 single farms dispersed in the landscape. The plan has to deal with all protection, maintenance and enhancement issues of relevance to the functions and aesthetic qualities of the landscape. The plan should be made at a level of detail, which makes it possible to use it as the main reference in an application as well as when implementing the variety of local projects. Thus, the plan should act as a reference point in a comprehensive tender for planting, habitat restoration and creation, common maintenance tasks etc.

A pilot project was established in 2002 involving the Danish Planting Association, a local community in Jutland, the county council and a research group from the Danish Centre for Forest, Landscape and Planning, KVL. The project was concluded in 2004 (Jørgensen *et al.* 2004). An outline of the plan is show in Figure 3.

Figure 3. The Odderbæk landscape plan.



The plan should be seen as a framework for concrete projects (new ponds, water course restorations for example) and more detailed plans (for the river valley and for three walking trails). (Jørgensen *et al.* 2004 p. 274).

The KVL group was included in the process because they have already been involved in two similar projects during the 1990s. A number of experiences have been gained from this process:

- Among local, rural communities there is a great interest for such collaborative projects. When around 250 local planting associations were asked if they wanted to participate in a pilot project - 40 gave a positive response.
- It is possible to arrive at a consensus plan for a future development, which include resolutions to small internal conflicts (of location of walking trails for instance) and which respect the overall planning objectives and designations of valuable landscapes set up by the county council.
- Collective landscape plans can supplement public planning and regulation but cannot replace it. It is not possible, through a process like this, to solve major conflicts concerning private property rights related to for example agricultural production or common goods involving more regional interests such as ground water protection beyond general legislation.
- The planning process has produced a number of ideas and solutions, for which the local farmers and other residents feel ownership, and the plan can function as a framework for individual and collective actions.
- The success of the continuing process of collaborative landscape management is highly dependant on the active participation of the relevant public authorities. The county council has – with great success and with many concrete results - been involved in the pilot project. In two similar projects from the 1990s one had a good co-operation with the Nature and Forest Agency (shortly described in Primdahl *et al.* 2003), the other did not have any public 'institutional back-up' and the community was to some degree disappointed (Shortly described in Primdahl 2000).

In conclusion, we find collective landscape planning to be an idea of very high potential for agri-environmental policy making and landscape management in Denmark. We also believe that a scheme to promote such practices is of relevance to other countries. In fact we can see similarities between collective landscape plans and the very idea behind the so-called fourth axis of the new rural development programme – the formation of 'local action groups' and their task to generate and implement local projects after the EU LEADER principle. Thus, the very design of the new rural development programme makes such collective approaches of relevance to EU member states in general.

Another argument for the usefulness of the collective approach is the fact that rural communities at the moment are becoming socially more diverse, and at the same time a common and growing interest is developing among residents. It is an interest directed towards protecting and enhancing the local landscape as 'space of place', a coherent spatial entity to which people can identify themselves and their everyday life. In this context collaborative approaches to shaping and managing the local landscape may show to be highly valued in most member states, although convincing examples must be developed.

Based on decades of experiences with collective hedgerow plantings new, broader schemes may develop, which prove to be appropriate responses to many of the current problems and visions related to the multifunctional agricultural landscape.

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Annex III: Nature Policy in the Netherlands: land purchase versus agri-environment schemes. By Aris Gaaff and Marie-José Smits.

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Abstract

This contribution describes recent nature policy in the Netherlands, in particular the relation between land purchases for nature development on the one hand and agri-environment schemes on the other hand. The focus is on the consequences of these policy instruments for the continuity of nature protection and on the budget.

Dutch nature policy mainly consists of three instruments: land purchase, nature development and management schemes. Purchase of land is an important instrument for nature development. However, it is expensive on account of high land prices, determined by other functions such as housing and industrial sites.

Besides, agri-environment schemes have been applied in the Netherlands for several decades. Development of modern agricultural practice led to discussions in the seventies about the combination of agricultural use and nature conservation. This resulted in the first schemes for nature management by farmers. Since about 65% of all land in the Netherlands is used by farmers (Berkhout & van Bruchem, 2006, p. 67), they play a key role in nature and landscape management.

Purchase of land for nature development and conservation on the one hand and agri-environment schemes on the other are partly interchangeable instruments. In 2002, for example, the government temporarily suspended land purchase while increasing the budget for agri-environment schemes. The trend over the last few years has been to gradually reduce the emphasis on land purchase in favour of nature management by farmers and other landowners. This is a major policy break which has created some tension between nature organisations and farmers. However, farmers were not unanimously in favour of the policy change either, as it had a negative influence on the price of land and therefore on their possessions.

What lessons can be learnt in the UK from the Dutch experience of land purchase versus agri-environment schemes? Land purchase is a long-term investment that needs political and public support on account of the considerable investment involved. In less prosperous economic times, budgets can easily be stopped. However, once the sites have been purchased, public ownership is a strong guarantee for sustainable management, biodiversity and landscape conservation.

Overview of nature policy in the Netherlands

Nature policy in the Netherlands is based on 3 pillars (LNV, 2002; LNV, 2006):

- The creation of a connected area of large natural reserves, the national ecological network (NEN; Dutch: *Ecologische Hoofdstructuur, EHS*). The idea is to expand the area of interconnected nature reserves, thereby increasing the basis for species and promoting exchange between populations. The ultimate aim for the NEN is to cover 728,500 ha;
- Management of nature areas belonging to and outside the NEN;
- Protection of certain species both inside and outside the NEN and the EU's Natura2000sites.

The NEN project is a large-scale project covering a period of almost 30 years. It started in 1990 and is hence currently half way. The NEN is created by purchasing land, including nature conservation areas and other land to be converted into nature areas and by management by farmers and other private owners. The final land purchases are foreseen in 2015, while conversion activities will continue until 2018. Part of the NEN will be created by changing the existing function, mostly agriculture, into nature without a change of ownership.

Management of the sites is performed in 4 different ways (see also *table 1*):

- by the State Forest Management Organisation (*Staatsbosbeheer, SBB*);
- by various NGOs; in practice these are the Dutch Society for the Preservation of Nature (*Vereniging Natuurmonumenten*) and 12 Provincial Nature Conservation Societies. These organisations receive financial support from the government according to the area and particular nature characteristics;
- by farmers involved in agri-environment schemes; in this case nature is a by-product of agricultural production;
- by private landowners.

Table 1: Overview of site-related nature policy in the Netherlands (*)

	NEN			**Non-NEN**		
investment	Land purchase			No purchase of land		
development	Conversion into nature and nature development			In specific situations, *e.g.* land reconstruction and recreation projects		
management	Non profit site management organisations (State and NGO)	Private owners	Farmers (AES)	Non profit site management organisations (State and NGO)	Private owners	Farmers (AES, in particular meadow birds)

(*) Protection of species is not included in the table
NEN is National Ecological Network
AES is Agri-Environment Schemes

The National Ecological Network (NEN) was introduced as an instrument with which to achieve the main aim of nature policy: protecting, strengthening and developing nature and landscape, as an essential contribution to the quality of life in the Netherlands and a sustainable society (MNP, 2005a, p. 65). One of the tasks of the NEN is to ensure that agreements about protecting and restoring biodiversity are met. The NEN policy relates to land as well as fresh and salt waters. This article focuses on the NEN on land.

The framework of the NEN policy allows for the purchase of land which can then be designated an area of nature development. It also allows for agri-environment schemes, whereby the land continues to be owned by the farmers who receive payment for managing the land according to certain agreed guidelines. Finally, part of the NEN will be realised by management by private owners (*not* farmers). In this contribution, we will focus on the comparison between land purchase and agri-environment schemes in the NEN, giving less attention to private management, as it is a relatively new instrument with as yet little participation. In particular we will study the consequences of both policy instruments for the government budget and the continuity of nature policy.

International context

There is a considerable spatial overlap between the National Ecological Network (NEN) and the various Natura 2000 areas. Apart from a few boundary differences, all Natura 2000 areas fall in their entirety or mainly within the NEN. In many cases, a Natura 2000 site objective is the same as an NEN nature objective for the same area. (MNP, 2005a, p. 62)[18]

The Netherlands is not only bound to guidelines originating from Brussels, but it also receives money from the European Union. There are roughly three headings for these contributions: the Common Agricultural Policy (CAP); the Structural and Cohesion Funds; and the Internal Policies of the EU (SME policy, European Network, Framework Programmes, LIFE projects). In total, this averages over 2,000 million Euros each year. By far the largest amount, around 60%, is linked to the common agricultural policy, including the Second Pillar: rural policy. (MNP, 2005a, p. 141)

Under all three headings, subsidies for nature and landscape are allocated, even if this is sometimes limited. Of all EU cash flows to the Netherlands, around 3% are explicitly aimed at developing and protecting nature and landscape. Direct EU subsidies for nature and landscape generally come from the Rural Development Programme (RDP). In 2003, EU rural development funds for the Netherlands totalled almost 70 million Euros. In the same year, around 48 million Euros (almost 70%) were channelled to measures aimed at nature and landscape. With its rural development funds, the EU contribution to nature policy totals 10% to 12% of the Netherlands' own resources (MNP, 2005a, p. 142). So the National Government spends around 400-480 million Euros of its own funds on measures aimed at nature and landscape.

The Netherlands uses half of the EU's nature related subsidies under the RDP (which are around two-thirds of the total RDP subsidy) for purchasing nature areas, in particular the non-wetlands NEN. Although England and North Rhine Westphalia also make huge investments in nature, the Netherlands does a lot in European terms. Also the total share of nature and landscape in the RDP is high compared with the

[18] The Netherlands Environmental Assessment Agency (Dutch: *MNP*) reports annually on the State of Nature and landscape in the Netherlands, as well as nature policy developments. These reports (Nature Balance) provide relevant information about the subject of this paper, which we freely quote. Stated opinions, however, are purely the authors' responsibility.

European average (Terluin & Venema, 2003; 2004). Thus the Netherlands gives its own interpretation to the RDP, acting on its own policy objectives.
Besides the EU contributions, the Dutch government and private parties also contribute to the projects subsidised by the EU. This co financing amounts to almost 70% for nature and landscape, apart from research. Over a half of this is contributed by the state: 46%. The provinces contribute 16%, the private sector 9% (MNP, 2005a, p. 143).

From purchase to management

The NEN budget has undergone successive adjustments in recent years, both downwards and upwards. Between 2000, when over 340 million Euros were spent on the NEN, and 2004 the budgets decreased on balance by an average of 8% per year. The aim of expanding the NEN to 275,000 hectares (which would include an area already held in state nature reserves) in 2018 remained unchanged during this period (MNP, 2005a, p. 66).

Various factors have affected the budget shifts. One of these factors is: policy commitment to the change from purchase to management and the adjusted resources since the governments led by Prime Minister Balkenende. That means: less land has been bought for the NEN and more has been invested in agri-environment schemes instead (MNP, 2005a, p. 66).

Table 2: Changes in the Ministry of Agriculture, Nature and Food Quality (LNV) Budget for Recruiting, Organising and Managing the NEN

Policy moment	**Stand**	**Changes per policy moment**
	million Euros	million Euros
Before Strategic Agreement of July 2002	**1,923**	
Strategic Agreement Balkenende I July 2002		- 408
Spring Memorandum 2003		- 30
Coalition Agreement Balkenende II May 2003		+ 377
Spring Memorandum 2004		- 190
Autumn Memorandum 2004		- 23
Budget 2005		- 98
Memorandum of Amendment November 2004		- 30
Spring Memorandum 2005		- 4
Total mutations		*- 406*
Budget 2005	**1,517**	

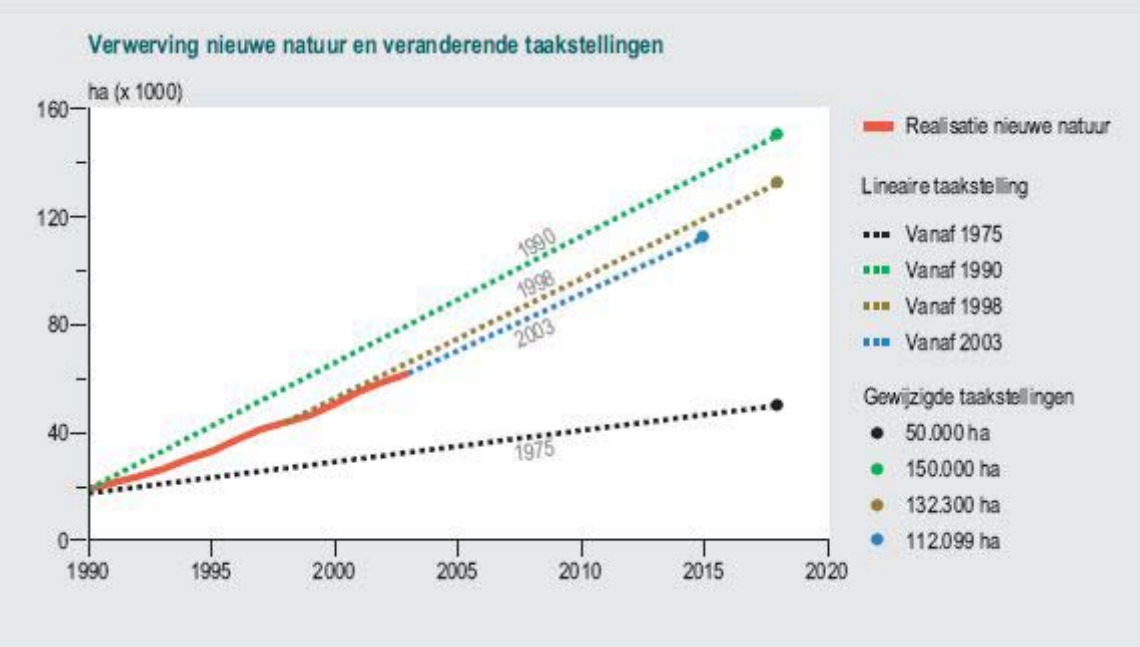
(Source: MNP, 2005a, p. 67; MNP refers to LNV)

The table above shows the budget shifts which were implemented at various policy moments. All the figures refer to the total budget for the period 2003-2007. Various factors have affected the reduction in the allocation of government funding for this period. Indicatively, about half the reduction since the first Balkenende government can be attributed to a new financing structure whereby expenditure is spread out over

a longer period, around 15% to a reduction in land prices and around 20% to policy changes, including the shift from land purchase to agri-environment schemes (MNP, 2005a, p. 67).

As illustrated in Figure 1. (below), the final targets for land acquisition have changed over time.

Figure 1: Progress towards, and evolution of, NEN goals



As a result of various adjustments, the following tasks are required to achieve the NEN (LNV, 2006).

- New nature: 111,700 ha acquired in 2015, developed in 2018.
- Management by private owners: 42,800 ha, completed in 2018.
- Management by farmers (agri-environment schemes): 118,700 ha, achieved in 2018. Of this total, 97,700 ha are related to the NEN. The rest (21,000 ha) lies outside the NEN and mainly involves management targeting meadow birds (excluding goose foraging areas).
- Wetlands: 2,900 ha purchased and 6,500 ha developed in 2010.

While national and regional spatial goals exist for the NEN, these are not necessarily always transferred to the definitive municipal planning maps, before land is purchased. The tendency to avoid definitive planning changes in advance of land purchase, occurs largely because changes to the specific permitted land uses could lead to large claims for 'damages due to planning changes', against the municipalities.

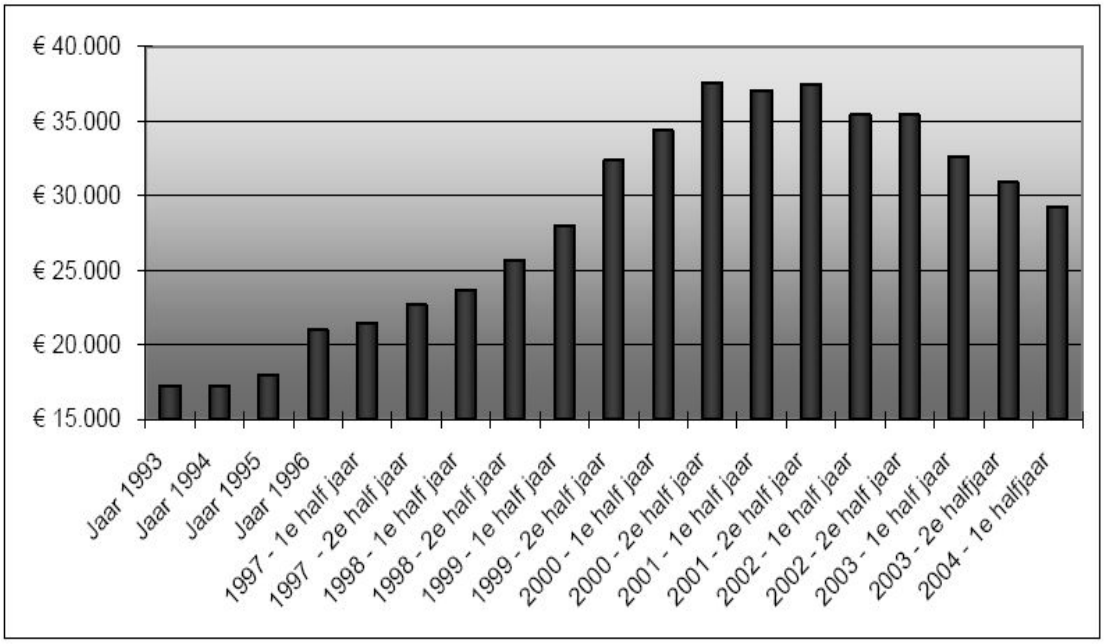
The main principal for land purchase in the Netherlands is that the land should be acquired through voluntary, negotiated, transactions at market prices. The amount of land that can be purchased for the NEN thus depends on the supply mainly from (retiring) farmers, the property market and on the annual budget. Compulsory purchase is possible under existing statutes however it has seldom, if ever, been

applied. There is strong respect for property rights in the Netherlands and compulsory purchase would be seen as an undesirable infringement of these property rights. In addition there is a policy commitment for the management of 27,000 ha robust connections. These robust connections must also be achieved through land purchase and private and agri-environment schemes.

Most of the money for nature and landscape is spent on management: around 285 million Euros (or 29%) of the total cash flow of 1,000 million Euros (figures relate to the year 2003). This includes management by site management organisations as well as management by private owners and management by farmers. Purchase and development cost 175 million and 103 million Euros respectively or 18% and 10% respectively. At the moment, the cash flows for purchase and development are almost 280 million Euros on an annual basis. The remaining expenditure relates to "overhead" (290 million Euros - 29%) or all costs that are not categorised as 'land purchase', 'nature development', or 'nature management' and a small amount for other specific tasks. Of this sum, 10% is paid to site management organisations and 90% is spent by the government on policy, legislation, monitoring, and project management (MNPa, 2005, page 134). In addition, there is expenditure for education, information and other activities (140 million Euros - 14%). All together, nature and landscape spending amounts to more than 1,000 million Euros (rounded) (0.2% of Dutch GDP; or 62 Euro per capita). The management expenditure can be considered as current expenditure aimed at nature protection. The expenditure for management is rising steadily, by around 4% a year (corrected for inflation) (MNP, 2005a, pp. 129-130).

The purchasing agency (DLG) has to pay market prices so the cost of land acquired approximately equates to the market price for farmland in the Netherlands. These are shown in Fig. 2 (below). For 2003, the Ministry of Agriculture, Nature and Food Quality reported an average price of land purchased for nature of 38,700 Euro/ha. However this included some land purchased for 62,200 Euro/ha in green development zones between cities in the West.

Figure 2



The purchase of land using EU funds has been approved in an annexe to the RDP for 2000-2006 as approved by the European Commission (28 September 2000, adjustments approved 9 October 2001 (C(2001)2814 dd. 9-10-2001)). EU funds are exclusively used for land acquisition, not overheads.

Different management strategies

There is a great deal of political focus on the change from purchase to management. This change is intended to broaden the involvement of landowners and farmers in nature management. Budgetary considerations also play a role. Every year, the budget debate hears calls for the allocation of more funds from purchase of nature to (agricultural) nature management. When considering the various management strategies, several aspects play a role. These are shown in the table below. (This whole section is based on MNP, 2005a, par. 6.4, pp. 82-89)

Table 3: Management by nature management organisations, private owners and farmers

	NEN		
	management by site management organisations	**management by private owners**	**management by farmers (AES)**
Objective	Main function nature	Several functions, including nature	Main function agriculture, besides nature

Continuity	Continuity is guaranteed	minimum 6 years nature	minimum 6 years agricultural function in combination with nature
Budget	costs in total 1,750 Euros per hectare per year	costs in total 1,470 Euros per hectare per year	costs in total 800 Euros per hectare year

(Source: MNP, 2005a, table 6.2, page 83)

Objectives of management strategies

Table 3 shows the formal objective of the policy for the different types of management. However, the objective of the policy is not always clear. For example, the contribution of agri-environment schemes to protecting farms appears to be an underlying consideration, but is not defined in formal policy.

Dutch nature policy distinguishes between nature objectives for large-scale nature, special nature and multifunctional nature. The main site management organisations Dutch Society for the Preservation of Nature, Provincial Nature Conservation Societies and State Forest Management Organisation contribute to the creation of large-scale, special and multifunctional nature.

'Private' land owners exclude the private, non-profit NGO's that act as site management organisations. They include farmers, who under a new scheme (below) may accept a permanent easement on their property (which passes to all future owners of the land) in return for compensation for the change in land value, from farmland to nature reserve (independently assessed), and an annual subsidy for nature management. Farming activities, for environmental maintenance, are the subject of ongoing legal debates. Private owners also include anciens and nouveaux riche, motivated by economics and 'devotion to nature' - who may take up the same schemes.

Private nature management can contribute to the creation of special nature and multifunctional nature. Little is yet known about the ecological effects of the change from purchase to private nature management; the scheme was only recently introduced and participation in the scheme is still very limited. Research shows that in 2004 the potential willingness to participate in bringing land under private nature management in future is almost 14,000 ha is, with 80% of the potential participants considering doing so within five years. The willingness to participate is an important indicator with regard to the main objective of the change: to broaden the involvement of managers. (MNP, 2005a, p. 83)

Opinions differ regarding the possibilities of achieving large-scale nature with private nature management. Van der Zee *et al.* (2004) see few opportunities, but there are examples of private owners who do achieve large-scale nature (forest). In practice, however, there may be fragmentation of the management.

The present agri-environment schemes contribute to achieving 'multifunctional nature objectives' (Van der Zee *et al.*, 2004). Data are available for consequences relating to meadow birds for sites managed by site management organisations compared with agri-environment schemes. This concerns trends between 1995 and 2003 for the

following species: blacktailed godwit, lapwing, redshank, skylark, meadow pipit, yellow wagtail, oystercatcher, shoveller duck and tufted duck. Taking these nine species together, although they are nationally under pressure, the trend in nature sites is positive. However in sites under agri-environment schemes and sites under normal agricultural use, the trend is negative. Per species there are also differences. For example the blacktailed godwit, redshank and tufted duck fares little better than in sites under agri-environment schemes. In sites under agri-environment schemes, the blacktailed godwit and the redshank fare less badly than in sites under normal agricultural use. (MNP, 2005b)

In the current agri-environment schemes the specified objectives include both inputs (management activities) and outputs (nature outcomes)

In recent years, light forms of management (involving less work and cost on the part of the farmer) often seem to be chosen for agri-environment schemes. This could be an important reason why meadow birds are performing poorly in sites under agri-environment schemes. Furthermore, nature sites are in areas with higher densities of meadow birds than sites under agri-environment schemes. The basis of the change is that with site management, private nature management and agri-environment schemes, the same (grassland) objectives are achieved. However, with the present schemes and available subsidies, agri-environment schemes will seldom be able to achieve the nature objectives that site managers can achieve. Practice shows that the nature objectives can often only be achieved if management is linked to development measures (MNP, 2005b).

Continuity management strategies

In order to achieve most of the nature objectives, *continuity of management* is required to get the planned species. For botanical values, development periods spanning decades are no exception. To protect developed or existing nature, perpetual management is often essential (MNP, 2005a, p.86).

In principle, nature management by site managers is endless. The land will remain in use as a nature site because this is the core activity of these organisations. However site managers can change the type of management. State Forest Management concludes annual agreements on this with the Ministry of Agriculture, Nature and Food Quality. The Dutch Society for the Preservation of Nature and Provincial Nature Conservation Societies enter into management contracts for six years. After these six years, they can choose other nature objectives to a limited degree. In the past, this occurred if other nature objectives were preferred or if it appeared that nature objectives could not be achieved. A condition for being eligible for the private nature management scheme is that the land is no longer in use for agricultural purposes and that a management contract is signed. The management contract stipulates the nature results to be provided by the management. After that period, the private nature manager can terminate the management. The contract period of private nature managers (six years) is therefore too short to guarantee successful botanic values. This depends on the continuation after the six years. Nothing is yet known about the continuation of private nature management, due to the change from purchase to management (MNP, 2005a, p.86).

The six year contracts entered into by farmers for agri-environment schemes are also too short to be able to develop botanic values. Protection objectives can be achieved, but only for a limited duration. However, 80% of the present agricultural managers indicate that they are willing to continue management (Leneman & Graveland, 2004). Willingness to participate in agri-environment schemes is good and it is not unusual that the schemes were oversubscribed, which had led to increased allocation of budgets.

More than 60 percent of the current participants in agri-environment schemes are big and medium-sized farms. The majority of these farms are involved in light meadow bird management. The small farms are responsible for half of the area of heavy meadow bird management and botanic management. The farms are involved in nature management due to the level of the compensation and their interest in nature. In general, the participating farmers are happy with the scheme (MNP, 2005b, p. 68).

Another aspect that is relevant to the continuity of nature management is the way in which the *planological zoning and planological protection* are organised. Here too, the three different forms of management vary. Lands which are owned by a site management organisation or private nature manager have or will be designated nature areas. Land under agri-environment schemes retains its agricultural status.

Management strategies budget

The costs of the three forms of nature management to the Ministry of Agriculture, Nature and Food Quality consist (depending on the form of management) of various components:

– annual expenditure for management costs, in the case of agri-environment schemes supplemented by compensation for loss of income and a small incentive;
– one-off contributions for land development;
– one-off expenditure for land purchase;
– expenditure over thirty years in compensation of the reduced value of the land or payment for the purchase of the land for the Dutch Society for the Preservation of Nature and Provincial Nature Conservation Societies (MNP, 2005a, p. 88)

The total annual costs to the Ministry of Agriculture, Nature and Food Quality of private nature management are 20% less on average than the cost of management by site management organisations. Agri-environment schemes cost the Ministry less money because the function of the land remains unchanged. However management payments for agri-environment schemes are higher (MNP, 2005a, p. 88).

Advantages and disadvantages of various forms of management

The table below shows the advantages and disadvantages of purchase and management by site management organisations compared with management by farmers (agri-environment schemes). Hereby the emphasis is laid on advantages and disadvantages regarding budget and continuity.

Table 4: Advantages and disadvantages of purchase for site management organisations compared with management by farmers (agri-environment schemes), emphasising the consequences for budget and continuity

	Purchase	**Management by farmers**
investment	is expensive, but sustainable	no purchase
development	is expensive and has risks (duration)	not applicable
management	by site management organisations, support from population (except where development is concerned), budget is varied	by farmers, uncertainty about knowledge and skill of farmers and about continuity, budget is varied

Purchase for site management organisations is expensive, particularly in the short term. This is due to the high price of land in the Netherlands. But once the land has been purchased and it has been designated a nature area, this function does not tend to change.

The development of the purchased land into a nature area when it was not previously one is also expensive. Moreover there are risks related to the land development. First of all there are the physical risks (e.g. contaminated land). Then there are risks regarding social response (people who are opposed to change, for example when nature objective types have to change). Finally, development can involve long procedures and sometimes changes in wishes and ideas regarding the function of the area and the nature objective types may occur. On the other hand, the Netherlands has a great deal of experience in the field of land development.

Where management by site management organisations is concerned, these are state-run organisations (State Forest Management) and private organisations (e.g. the Dutch Society for the Preservation of Nature). The average Dutch citizen has a great deal of faith in these organisations. The cost of management largely depends on the wishes for the area. Furthermore, money is necessary for the maintenance of the organisations ("overhead").

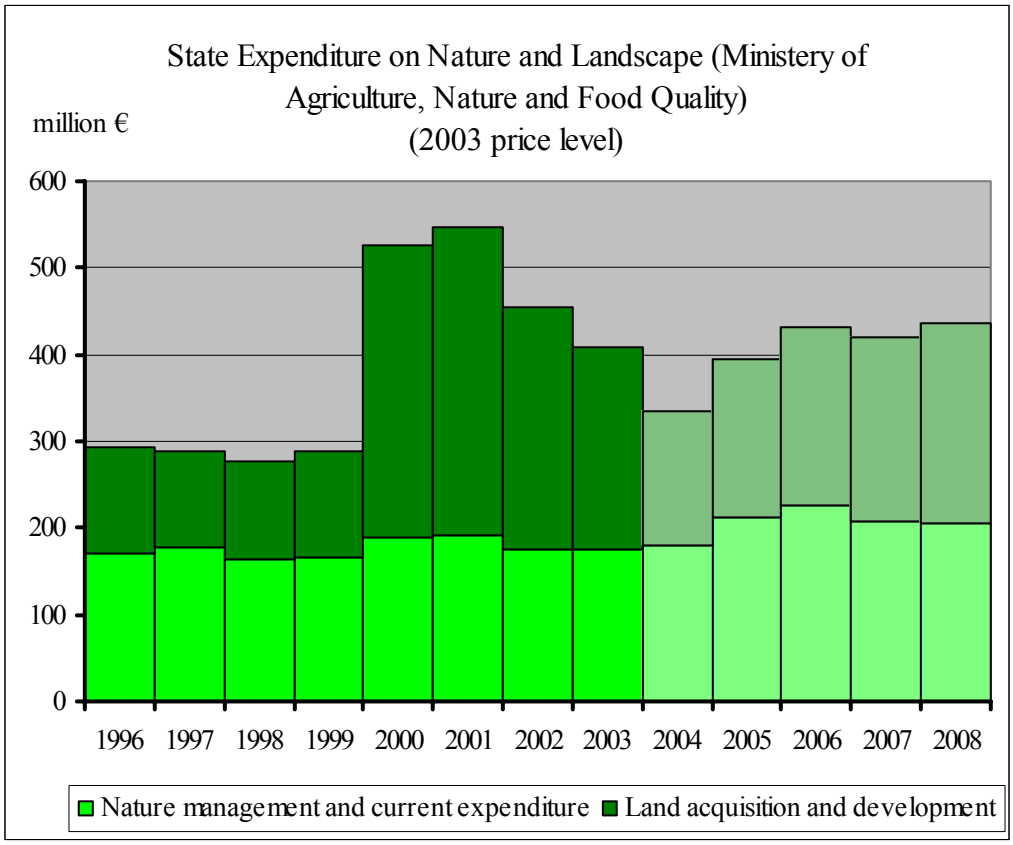
For management by farmers (2nd column), no land is purchased or developed. Thus the short term expenditure is much lower. The land is managed by farmers, possibly raising questions about the required knowledge and skill of farmers in this field and about continuity. The costs of the management again depend on the wishes regarding the area. In the short term, agri-environment schemes are less expensive than purchase. In the long term, the costs are comparable (MNP, 2005b). There are also fairly high transaction costs because contracts have to be drawn up with many farmers for a relatively short period (6 years). On the other hand, farmers incur the costs involved in submitting the application and collecting the required information during the course of the contract. In a recent report on the realisation of the NEN, the Court of Audit concludes that agri-environment schemes offer insufficient guarantee for continuity because contracts cover a period of 6 years and planological protection is limited (Algemene Rekenkamer, 2006).

The continuity of nature management depends on farmers' desire to participate and the budget. Whether farmers decide to take part in agri-environment schemes depends on many external factors, such as the market situation, employment opportunities elsewhere, decisions regarding the Common Agricultural Policy, etc.

Lessons based on Dutch nature policy

As indicated above, the budget for the NEN has been adjusted several times. Figure 3 below shows the turbulent budget developments for the NEN. Interestingly, the budget for management, including agri-environment schemes, is much more stable, showing a slight upward trend. The budgets for the NEN are seem to be related to the economic situation in the country and the political situation.

Figure 3: Development of state expenditure on nature and landscape in the Netherlands (*)



(*) Realisations 1996-2003, budgets 2004-2008
Source: MNP, 2005a, p. 130

Political willingness

In order to create the NEN, political support is very important. The NEN requires huge investments over a long period. In the Netherlands, the question whether or not there should be a NEN is not an issue. There seems to be political agreement that the NEN is the right instrument with regard to nature policy. Furthermore, the Dutch population strongly supports the NEN. But politicians do see possibilities for changes in how the NEN is interpreted. This particularly concerns the shift of money from land purchase to management by private owners and farmers. In particular, management by farmers, or agri-environment schemes, is less expensive in the short term. In addition politicians have expressed the desire to broaden the involvement of landowners and farmers in nature management. A final issue which has never officially been expressed is the desire to give farmers extra opportunities to earn money to keep them in business.

The recent decision to emphasize nature management at the expense of land purchase is understood to be a largely autonomous Dutch political decision. The decision was driven by budgetary restrictions and increasing private management of nature, rather than any pressure to distribute funding more widely as a result of reforms of the CAP.

Effectiveness

Little is yet known about the effectiveness of management by site management organisations compared with management by private owners and farmers. This relates to the effectiveness in protecting biodiversity. There is no data available to analyse the effectiveness, with the exception of some data about meadow birds. There are calls in the Netherlands to make effectiveness easier to measure, in particular with regard to agri-environment schemes. The Court of Audit points out that an operational system for measuring nature quality in relation to the objectives is lacking (Algemene Rekenkamer, 2006).

The debate about the effectiveness of agri-environment schemes was launched by Kleijn in a controversial article in Nature (Kleijn *et al*., 2001). In this article he claimed that agri-environment schemes in the Netherlands are not effective to protect biodiversity. Later articles by Kleijn and colleagues were less strident (e.g. Kleijn & Sutherland, 2003; Kleijn *et al*., 2006). There are plans to collect more specific data so that in future more can be said about the effectiveness of agri-environment schemes.

Conclusion

Figures relating to budgets for different forms of nature policy are fairly well known. However figures about continuity and in particular the consequences of continuity for effectively protecting biodiversity are largely unknown. With regard to the required budgets, it is clear that agri-environment schemes are the least expensive form of management in the short term, and thus the least expensive way of fulfilling the policy objectives for the NEN. At the same time, however, agri-environment schemes attract the most questions regarding continuity. The contracts are usually entered into for 6 years. Many farmers, around 80%, have indicated that their desire to continue with agri-environment schemes after the end of the contract. But the good intentions of farmers offer less hard guarantees for continuity than the purchase of land for site management organisations.

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Annex IV: The U.S. Conservation Reserve Program. By Ralph E. Heimlich.

Ralph E. Heimlich
Agricultural Conservation Economics

Development of Land Retirement Programs

History and Context

Land retirement has been a common agricultural policy tool in the United States since the 1930s, when dual concerns over low farm income and resource problems, such as soil erosion, flooding, and drought, were both addressed by reducing cultivated acreage. The United States has periodically instituted programs to idle cropped acreage, with peak enrolments varying inversely with net farm income (figure 1). Historically, these programs have been instituted when agricultural prices were low, and acreage came out of enrolment when prices recovered, often with a lag. The recent period (since 1996) is an anomaly since we have both farm income and acreage retired increasing.

Following World War II, commodity stocks again began to grow as European production resumed. The Agricultural Act of 1956 created the Soil Bank to help establish a balance between supply and demand by idling 15-30 million acres of land planted to surplus commodities. As part of the Soil Bank, the Acreage Reserve Program paid farmers to convert land planted in surplus commodities to conserving uses in 1956, 1957, and 1958 (Wilcox, Cochrane, and Herdt, 1974). Also as part of the Soil Bank, the original Conservation Reserve Program provided for 3- to 10- year contracts to retire land designated by the farmer without regard to specific resource conditions (Crosswhite and Sandretto, 1991). These long-term contracts expired in 1972. When stocks rose during the 1960s, annual acreage set-asides in the Acreage Reduction Programs (ARP) were again used heavily and a modest amount of long-term cropland retirement occurred under the Food and Agriculture Act of 1965. With demand outpacing supply in the 1970s, relatively little land was set-aside, but the amount of idled land grew again in the 1980s as stocks again rose.

Modern CRP

In 1985, at a time of then-record stocks, long-term land retirement re-appeared after more than a decade as the current Conservation Reserve Program (CRP), authorized in the Food Security Act of 1985 (FSA 1985). With an original goal of retiring 45 million acres of highly erodible land, CRP had 36.4 million acres in conservation cover by 1990 (Osborn, 1994, 1997; Smith, 2003; Magleby, et al., 1995; Crosswhite and Sandretto, 1991; Hellerstein, 2006).

Modern CRP was originally envisioned and implemented to enroll land based on bids by farmers, in an effort to use market-based principles to minimize the cost of the program (Ogg and Zellner, 1984; Dicks, 1985; Ervin and Mill, 1985). The initial attempt collapsed under two pressures. First, FSA personnel in the field were not technically equipped to evaluate the economic and environmental merits of bids submitted by landowners. They appealed to national managers for guidance, and the Maximum Acceptable Rental Rates (MARRs) quickly attained the status of an offer

schedule. Second, the legislated goal of 45 million acres, combined with administration and congressional pressure to quickly enrol acreage to relieve the farm recession gripping the agricultural economy in the mid-1980s meant that virtually no offer would be refused. No bid system can succeed in the face of nearly complete information asymmetry and an imbalance between demand and supply of land to retire.

An improving agricultural economy in the late 1980s led Congress to set the 36.4 million acres enrolled by 1990 as an enrolment cap in the Food, Agriculture, Conservation and Trade Act of 1990 (FACTA 1990). The cap, expanded emphasis on a broader array of environmental objectives for CRP, and criticism of the prevailing MARR rates opened the door to a true bidding scheme (Berner, 1989; Ogg, et al., 1989; Richelderfer and Boggess, 1988; U.S. GAO, 1989). The remaining acreage enrolled in 1991-1996 used a system of soil-adjusted rental rates (SRR) and a multi-component environmental benefit index (EBI) to rank bids that were then selected from all those submitted at the national level (Osborn, 1993; Barbarika, *et al.* 1994; Cattaneo *et al.* 2006; USDA, FSA, 2006 a).

Past land retirement programs had typically been abandoned when conditions in the agricultural economy improved. In 1996, despite a recovery in crop prices, CRP was reauthorized at a total enrolment of 36.4 million acres in the Federal Agriculture Improvement and Reform Act (FAIR 1996). The system of bids evaluated based on their SRR/EBI was refined and used to evaluate nearly 23 million acres of CRP contracts that expired in 1996 and 1997, originally enrolled in the first traunch of CRP between 1985 and 1992. Approximately 61 percent of the acreage enrolled in CRP since 1996 was formerly enrolled in CRP, falling from 72 percent in the first reenrolment period (signup 15) to only 8 percent in the most recent general signup. Many reenroling acres took the opportunity to improve the kind and quality of conservation cover planted, in response to incentives offered in the EBI scoring process.

An exception to the SRR/EBI evaluations of whole-field bids was made in 1990 for bids to enrol partial fields, particularly as buffers along streams and windbreaks in fields. These practices were allowed to enroll at any time, not just during general signup periods, because the benefits of trapping sediment, nutrients, and windblown dust in these strips were believed to be very high, and because they could not be equitably evaluated using the whole-field system.

Continuous signup was supplemented by a hybrid Federal-State cooperative program called the Conservation Reserve Enhancement Program (CREP; USDA,FSA, 2006 e), authorized in the 1996 FAIR Act, that allowed States to designate priority areas for enrolment, offer higher incentives for enrolling and cost-share for practices relevant to specified environmental goals. As of 2005, 3.2 million acres are enrolled under the continuous signup. Thirty-one CREP agreements signed with 26 States are allocated 2.1 million acres, of which 851,000 acres have actually been enrolled. Also under CRP authority is a Farmable Wetlands Program, originally established as a pilot for six States in 2001, to enrol up to 1 million acres of farmable wetlands and associated buffers in 10-15 year contracts on wetlands currently being farmed (USDA,FSA, 2006 f).

Congress did not have to reauthorize CRP in 2002 farm legislation, but they raised the enrolment cap to 39.2 million acres in the Farm Security and Rural Investment Act of 2002 (FSRI 2002). Seeking to avoid the crunch of reenroling more than 20 million acres again as the 1996-era contracts expire, FSA issued a policy on contract renewal and reenrolment in January 2006 (USDA, FSA, 2006 b). Based on the EBI score at the time the land was last enrolled, the top one-fifth of the current acreage was offered 10-year contract renewals at updated rental rates, while the succeeding quintiles were offered declining contract extensions of 5, 4, 3 and 2 years at the current rental rate. Acreage must be determined to be in the conservation cover originally contracted for, and land in national conservation priority areas (Long Island Sound, Chesapeake Bay, Great Lakes, Prairie Pothole wetlands, and Long-leaf pine areas) was given additional weight. As of August, 2006, 84 percent (13 million acres) of re-enrolment and extension (REX) offers for the 15.5 million acres expiring at in September 2007 had been accepted (USDA, FSA, 2006 g, p. 16).

If Congress reauthorizes CRP in 2007 legislation and when the process for renewals and extensions plays out, a large acreage will have been under CRP contract for as long as 30 years. While difficult to demonstrate, some of this acreage has probably been idled under various long-term programs for much of the time since 1933.

Land retirement programs in the U.S. (including annual set-asides) averaged 31 million acres between 1933 and 2005, (8.7 percent of cropland used for crops; figure 2). Land retirement ranged as high as 78 million acres (20 percent) in 1983. In only 10 years (1948-55 and 1980-81) was no cropland retired in such programs. What have been the benefits and costs of such an extensive and long-lived experiment in retiring land from commodity production?

Figure 1

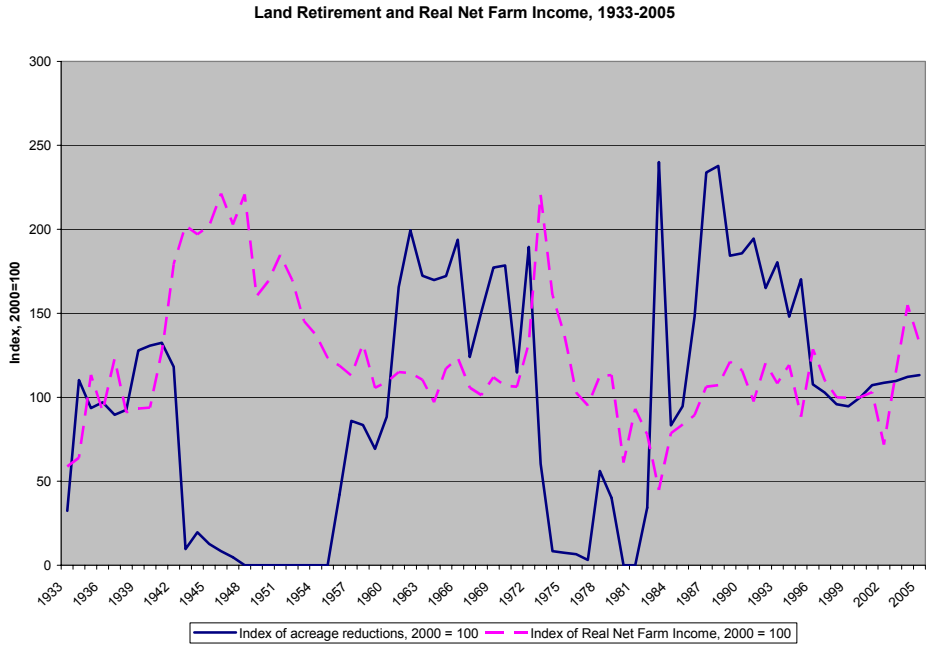
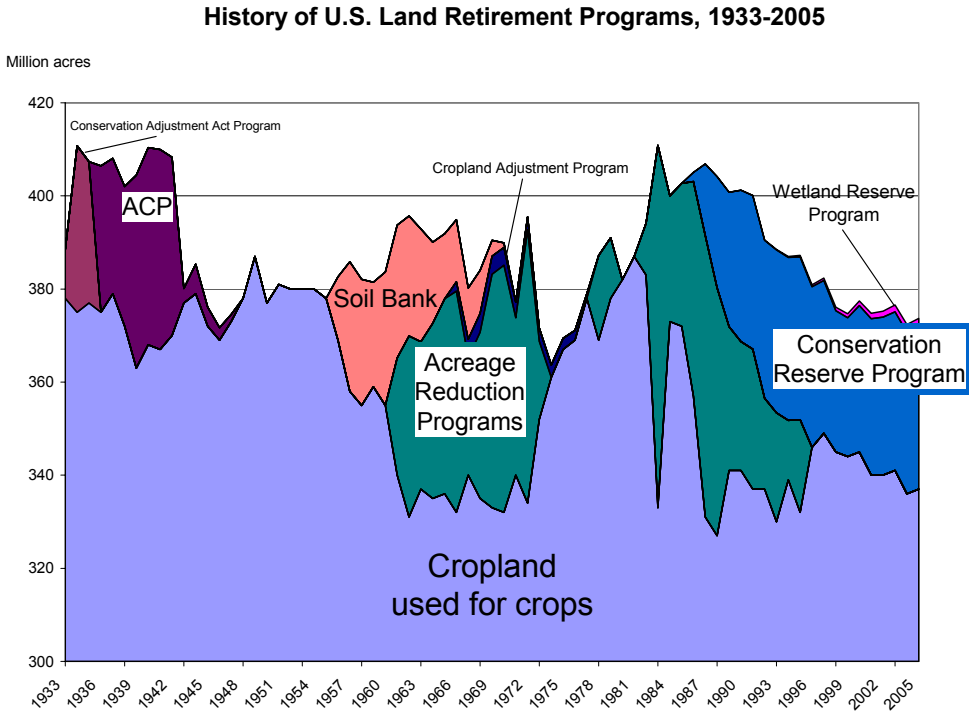


Figure 2



How Does U.S. Land Retirement Work?

The Conservation Reserve Program (CRP) and its predecessors has been the largest land retirement program throughout this period, and the largest U.S. conservation program of any kind. CRP is a voluntary program that offers annual rental payments, incentive payments for certain activities, and cost-share assistance to establish approved cover on eligible cropland. One potential difference between the United States and many other countries is that in the United States, private landowners have almost no limitations on how they can use their land for agricultural or forestry purposes. There are no national laws, and only a few State or local regulations that significantly restrict landowners' use of their land (Taylor, 2001). Consequently, any attempt to influence land use or adoption of conservation practices has to rely on direct voluntary incentives, or indirect incentives provided through other voluntary programs.

Procedures are different for the continuous and CREP signups. A landowner meeting the eligibility requirements for continuous signup can offer land for enrolment at any time during the year, and receive the SRR rent and no more than 50 percent of the participant's cost to establish approved practices. FSA offers financial incentives of up to 20 percent of the soil rental rate for field windbreaks, grass waterways, filter strips, and riparian buffers, and 10 percent for land located within EPA-designated wellhead protection areas. These are added to the SRR each year.

FSA also offers an up-front signing incentive payment (CRP-SIP) up to $100 per acre for eligible participants who enroll certain practices, and a practice incentive payment (CRP-PIP) equal to 40 percent of the eligible installation costs for eligible participants

who enroll certain practices. Therefore, continuous signup has rents up to 120 percent of the normal SRR rent, and shares up to 90 percent of the cost of practice installation.

National Level
CRP provides an incentive to farmers to plant long-term resource-conserving cover, such as permanent grassland, shrubs or bushes, and trees, to improve soil, water, and wildlife resources. CRP is funded through the Commodity Credit Corporation (CCC), which pays the annual rental payment and pays up to 50 percent of the participant's costs in establishing approved cover and practices. Cover is established based on a conservation plan developed between the farm operator and the government conservationist and is under a 10-15 year contract.

CRP is administered by the U.S. Department of Agriculture's Farm Service Agency (FSA), which sets overall policy for running the program, administers the bid-selection process, and makes payment to farmers for rental and conservation practice cost-sharing. USDA's Natural Resources Conservation Service (NRCS) provides technical support, determining whether land offered for the program meets eligibility requirements in terms of erodibility and other resource conditions, helping the farmer plan and implement conservation practices, and reviewing the progress of establishing conservation cover. Other Federal agencies, such as USDA's Cooperative State Research and Education Extension Service, and the Forest Service, and Department of the Interior's U.S. Fish and Wildlife Service, provide education and extension services, technical assistance, and expert knowledge in administering CRP.

State Level
Both FSA and NRCS have State and local offices that are tasked with implementing the program in the field. State Technical Committees in each State, consisting of the NRCS State Conservationist, the FSA State Executive Director, representatives of Federal agencies operating in the State, and representatives of State agricultural, forestry, and fish and wildlife agencies, provide much of the guidance for decisions related to the program in their State (U.S. GAO, 2002). Locally-elected county agriculture committees and soil and water conservation districts support the program at the county level, sometimes with staff members employed directly by the district.

Landowners
Landowners and farm operators participate in CRP by offering specific parcels of land for retirement. Eligible land must be:

- Cropland that was planted to an agricultural commodity in 2 of the 5 most recent crop years; or
- Certain marginal pastureland previously enrolled in other programs, or that can serve as buffer strips along streams or water bodies.

In addition to the eligible land requirements, cropland must have resource problems or concerns that make it desirable to retire, such as:

- Have an Erosion Index (EI) of 8 or higher or be considered highly erodible land according to the conservation compliance provisions;
- Be a cropped wetland;

- Be devoted to highly beneficial environmental practices, such as filter strips, riparian buffers, grass waterways, shelter belts, wellhead protection areas, and other similar practices;
- Be subject to scour erosion;
- Be located in a national or state CRP conservation priority area; or
- Be cropland associated with or surrounding non-cropped wetlands

To be eligible for placement in CRP, land must be either cropland (including field margins) that was planted to an agricultural commodity 4 of the 6 crop years from 1996 to 2001, or certain marginal pastureland that is enrolled in the Water Bank Program or suitable for use as a riparian buffer or for similar water quality purposes. Practices eligible for continuous signup include:

- Riparian buffers;
- Wildlife habitat buffers;
- Wetland buffers;
- Filter strips;
- Wetland restoration;
- Grass waterways;
- Shelterbelts;
- Living snow fences;
- Contour grass strips;
- Salt tolerant vegetation; and
- Shallow water areas for wildlife.

Land within an Environmental Protection Agency (EPA)-designated public wellhead area may also be eligible for enrollment on a continuous basis.

Enrolment in CREP is similar to the continuous signup, except that States may proscribe additional eligibility criteria, and offer additional incentives that can supplement either the SRR, additional signup or practice incentives, or additional technical or practice assistance. One of the more popular additional incentives is to offer "piggy-back" permanent easements that permanently acquire the cropping rights beginning after the CREP agreement expires. Because the easement payment is paid at the beginning of the contract, and is discounted 15 years to account for the CREP contract, piggy-backing reduces the cost of the easement and provides certainty to the landowner. Nineteen of the 36 CREP agreements offer some form of easement.

Costs of Land Retirement

Budget outlays for rental and cover establishment cost-sharing
Direct budgetary outlays for USDA land retirement programs totalled nearly $35 billion (2006 constant dollars) since modern CRP was established in the 1985 FSA (table 1). Counting all the expenditures recorded for land retirement since 1933, the total is nearly $49 billion.

Table 1—Nominal and real direct costs of land retirement programs, rental and cover establishment

Cost category	Nominal dollars (million)	2006 constant dollars (million)
Land utilization/retirement of submarginal land (1937-50)	$25.1	$252.1
Soil Bank (1956-72)	$2,478.2	$13,069.9
CRP (1985-2005)	$28,986.8	$35,397.2
Rental and cover establishment (since 1933)	$31,490.1	$48,719.2
Sources: Agricultural Conservation Economics calculations using USDA program and budgetary data, various years.		

Average rental rates for CRP land increased from $26 per acre (nominal dollars) in 1987, to a peak of $53 per acre in 1998 at the end of the first traunch of enrolments (figure 3). With reenrolments after 1997, average rental rates fell to $42 per acre, but have risen to a recent average of $46 per acre. Rents for continuous and CREP enrolment are higher than for general signups because of bonuses which compensate for enrolling smaller acreage parcels.

When modern CRP began in 1985, the sole objective was reducing soil erosion on highly erodible cropland. Conservation cover was almost entirely grass (often introduced grass species) and trees (usually softwood). Costs for conservation cover averaged $27 per acre in the first traunch of CRP signups (1986-96), but rose to $82 per acre, on average, for the second traunch (1997-2005). This was generally on a 50 percent cost-share basis, so the landowner paid a like amount. The increase in cost-share is partly due to continuous and CREP enrolments that have higher cost-share rates for cover, but mainly because the emphasis has shifted to include wildlife habitat and wetland restoration, with more complex conservation cover involving mixes of different native and adapted species, and bottomland hardwood trees. Conservation cover practices are recompensed at rates ranging from nearly nothing for existing trees (usually from a prior contract in the first traunch), to $1,740 per acre for sediment retention basins (CP 26) (figure 4). The largest acreage has been enrolled in practices with the least cost, particularly those reenroling with existing cover. This is rewarded in the EBI scoring.

Figure 3

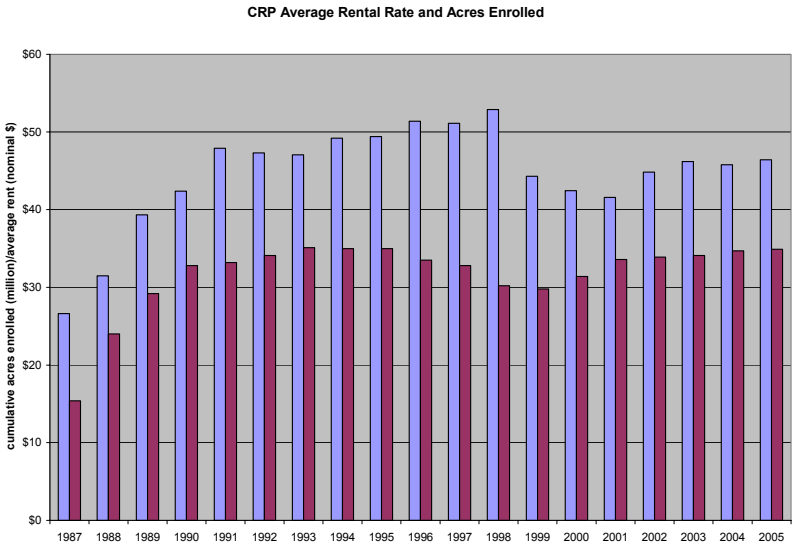
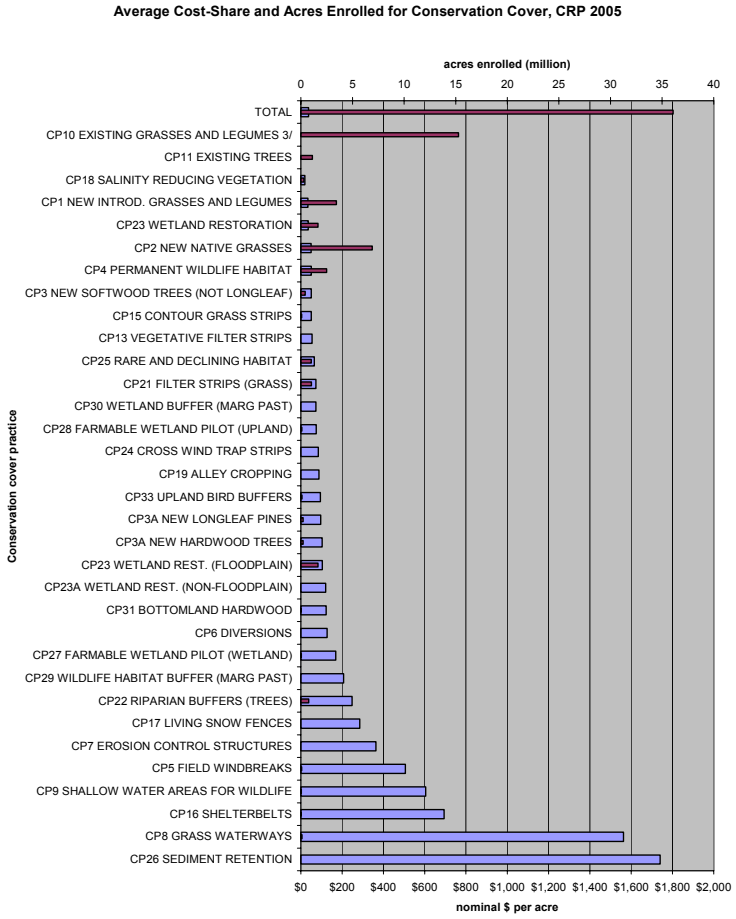


Figure 4



Source: USDA, FSA, Summary and Enrollment Statistics, 2005, page 11.

Administrative costs

Since 1985, more than $1.9 billion in 2005 constant dollars was expended on technical assistance to evaluate farmers' applications for land retirement programs and assist them in establishing cover on lands retired. In the first traunch of CRP enrolment from 1986 to 1996, 37 million acres were signed up out of 57 million offered (table 2). NRCS spent an average of $3.38 per acre offered and $5.21 per acre accepted, while FSA spent $14.23 per acre offered and $21.92 per acre accepted, totalling $18-$27 per acre overall. In the second traunch from 1997-2005, however, NRCS expenditures increased in proportion to the burden of assessing a host of environmental dimensions on each offered parcel, and helping with increasingly complex cover mixes. FSA turned to computer- and internet-based methods to administer the CRP contracts, reducing their costs per acre. Consequently, NRCS technical assistance costs rose to $7.49 per acre offered and $11.09 per acre accepted, while FSA costs dropped to $5.58 per acre offered and $8.26 per acre accepted. Overall costs dropped to $13-19 per acre.

Table 2—Technical assistance and support expenditures per acre signed up and offered, 1986-96 and 1997-2005 averages

	CRP acres	NRCS Technical Assistance Expenditures	FSA Support Expenditures	Total
	Million acres	2005 constant dollars per acre		
1986-1996 average, signed up	37.0	$5.21	$21.92	$27.13
1997-2005 average, signed up	35.4	$11.09	$8.26	$19.35
1986-1996 average, offered	57.0	$3.38	$14.23	$17.61
1997-2005 average, offered	52.4	$7.49	$5.58	$13.08

Source: Agriculture Conservation Economics calculations based on USDA conservation expenditure data and CRP offer and enrolment data.

Benefits of Land Retirement

Benefits of land retirement flow from three related, but often conflicting, areas. First, the impacts of retiring land from crop production on the primary markets for agricultural inputs and outputs can be viewed as benefits. Second, reductions in government expenditures for other agricultural programs intended to control commodity supplies, support prices, and raise farmer incomes are benefits. Finally, some few of the ecological changes wrought by retiring land from production can eventually translate into measurable market transactions and less measurable changes in welfare that aren't marketed.

Land Use Change and Supply Control

Land retirement isn't just a conservation program, but controls aggregate commodity supplies and supports prices. While U.S. agricultural supply controls were repealed in the 1996 Federal Agriculture Improvement and Reform Act (1996 FAIR), the first traunch of modern CRP substituted for annual land retirement to control supply.

CRP idled more than 23 million acres of crop base acreage, plus an additional 11 million acres of cropland without base (table 3). If these acres had not been idled

under CRP, they would have remained eligible for payments under commodity programs. At the same payment per acre, CRP land would have garnered $15.7 billion in commodity program payments between 1986 and 2005, or an average of $783 million per year. This is 53 percent of CRP's annual $1.5 billion cost, not counting paid land diversions, price effects from the additional production, and program crop production on the nonbase acreage enrolled.

Barbarika and Langley (1992) estimated that acreage reduction programs (ARPs) would have risen from a 15-year average of 10.8 percent for corn to as high as 15.2 percent, 12.8-16.8 percent for wheat, and 21.8-24.5 percent for cotton, without CRP. Studies by Barbarika and Langley (1992), USDA, ERS (1994), USDA (1996, 1997), and De La Torre Ugarte and Hellwinckel (2006) under widely varying assumptions about baseline supply and demand and program parameters estimated increased commodity expenditures ranging from $9.7 billion to $33 billion in the absence of CRP.

Negative Externalities Reduced

CRP was initially focused on reducing erosion on highly erodible land so changes in soil erosion are the most important, and most well-documented physical change associated with the program. The original erodibility index level proposed for a reserve was based on sheet and rill erosion, covered only 33 million acres (8 percent of cropland) and accounted for 44 percent of total soil erosion in tons (Heimlich and Bills, 1984). As modified to encompass wind erosion and normalized by the soil loss tolerance value (EI= RKLS/T and CI/T), EI was set at 15, and covered 50.8 million acres (12 percent of cropland), accounting for 34.6 percent of sheet and rill erosion and 29.9 percent of wind erosion (McCormack and Heimlich, 1985, table 4). In implementing CRP, the definition was expanded by setting EI to 8, covering 125 million acres (29.4 percent of cropland) and accounting for 55 percent of sheet and rill erosion and 58 percent of wind erosion. By diluting the erodibility standard to expand the number of acres eligible for the program, the focus on retiring the most highly erodible cropland was blunted. Only 17 percent of the most highly erodible land (EI > 15) was actually enrolled in CRP, accounting for only 5.6 percent of all sheet and rill erosion and 8 percent of wind erosion.

Despite the dilution of targeting standards, CRP has been a big part of U.S. erosion control efforts, reducing erosion 379 million tons, 27 percent of sheet and rill erosion reductions and 40 percent of wind erosion reductions between 1982 and 1997 (table 5, Claassen, et al., 2004).

Soil productivity impacts of this reduction in soil erosion are based on work done in the early 1980s (Crosson and Stout, 1983; Larson, et al., 1983; Williams, et al., 1985; AAEA, 1986). ERS estimated soil productivity gains based on EPIC model runs for soils in which acreage had been enrolled at $0.6-$1.7 billion for the then-current 33.9 million acre enrolment, and $0.8-$2.4 billion for a complete 45 million acre reserve (Osborn and Konyar, 1990; Young and Osborn, 1990). Feather and others (1999 p. 23), made an estimate of $1.9 billion (NPV over 10 years at 3 percent) based on Young and Osborn (1990). More recent estimates based on the 1997 NRI data and assumptions about post-CRP land use and cropping practices are $1 billion (NPV over 10 years at 3 percent, Sullivan, et al., 2004, p. 23). Using these coefficients and the

1982-1997 erosion reductions for CRP, I estimate onsite soil productivity benefits of $202 million per year, or $1.7 billion (NPV over 10 years at 3 percent , table 6).

Table 3—Base acres enrolled in CRP by crop and estimated cost if not enrolled, 1986-2005

Year[1]	Corn	Sorghum	Barley	Oats	Wheat	Cotton	Rice	Nonbase[2]	Total CRP
	Million acres enrolled								
1986	0.2	0.2	0.1	0.1	0.6	0.1	0.00	0.7	1.9
1987	2.3	1.2	1.1	0.5	4.2	0.7	0.00	5.4	15.3
1988	2.8	1.9	1.9	0.9	7.1	1.0	0.00	8.3	23.9
1989	3.4	2.2	2.4	1.1	8.8	1.2	0.01	9.9	28.9
1990	3.8	2.4	2.7	1.3	10.3	1.3	0.01	10.8	32.5
1991	3.9	2.4	2.8	1.3	10.4	1.3	0.01	11.0	33.0
1992	4.1	2.4	2.8	1.4	10.6	1.4	0.01	11.4	34.0
1993	4.3	2.5	2.8	1.4	10.8	1.4	0.02	11.7	35.0
1994	4.3	2.5	2.8	1.4	10.8	1.4	0.02	11.7	35.0
1995	4.3	2.5	2.8	1.4	10.8	1.4	0.02	11.7	35.0
1996	4.3	2.5	2.8	1.4	10.8	1.4	0.02	11.2	34.5
1997	4.3	2.5	2.8	1.4	10.8	1.4	0.02	9.5	32.8
1998	4.3	2.5	2.8	1.4	10.8	1.4	0.02	7.1	30.3
1999	4.3	2.5	2.8	1.4	10.8	1.4	0.02	6.6	29.8
2000	4.3	2.5	2.8	1.4	10.8	1.4	0.02	8.2	31.4
2001	4.3	2.5	2.8	1.4	10.8	1.4	0.02	10.3	33.6
2002	4.3	2.5	2.8	1.4	10.8	1.4	0.02	10.7	34.0
2003	4.3	2.5	2.8	1.4	10.8	1.4	0.02	10.8	34.1
2004	4.3	2.5	2.8	1.4	10.8	1.4	0.02	11.4	34.7
2005	4.3	2.5	2.8	1.4	10.8	1.4	0.02	11.6	34.9
CRP expenditures if not retired (million $)									
1986	$20.7	$17.9	$5.0	$0.1	$26.4	$10.1	$0.2	$0.0	$80.4
1987	$430.3	$125.5	$39.4	$0.5	$179.8	$123.2	$0.6	$0.0	$899.3
1988	$343.5	$136.7	$10.9	-$0.1	$73.5	$66.1	$0.1	$0.0	$630.7
1989	$133.3	$79.5	$11.8	$0.1	$6.1	$144.0	$1.4	$0.0	$376.3
1990	$124.1	$78.2	-$31.2	-$0.7	$104.6	-$10.1	$2.2	$0.0	$267.1
1991	$121.5	$52.3	$21.9	$1.9	$416.3	$42.0	$2.9	$0.0	$658.8
1992	$107.6	$34.9	$62.9	$5.4	$252.6	$143.3	$2.6	$0.0	$609.3
1993	$301.5	$102.3	$67.7	$2.7	$327.8	$246.7	$3.4	$0.0	$1,052.1
1994	$33.9	$32.7	$79.5	$1.1	$266.4	$161.0	$3.7	$0.0	$578.3
1995	$126.0	$39.7	$54.6	$4.1	$125.9	$8.4	$4.0	$0.0	$362.7
1996	$109.1	$48.7	$45.5	$2.5	$213.7	$67.2	$2.7	$0.0	$489.5
1997	$138.5	$69.3	$44.8	$2.3	$203.2	$58.2	$2.2	$0.0	$518.5
1998	$152.6	$75.2	$74.4	$4.8	$360.1	$125.7	$2.3	$0.0	$795.1
1999	$299.7	$133.2	$122.2	$12.1	$593.3	$181.3	$3.9	$0.0	$1,345.8
2000	$547.0	$262.5	$191.8	$18.9	$920.5	$351.7	$8.7	$0.0	$2,301.1
2001	$357.1	$115.0	$124.2	$11.4	$532.6	$169.7	$6.4	$0.0	$1,316.5
2002	$161.0	$53.2	$54.9	$2.0	$213.7	$339.5	$5.0	$0.0	$829.3
2003	$77.3	$27.7	$23.8	$1.2	$194.9	$307.1	$6.4	$0.0	$638.4
2004	$132.8	$70.1	$74.5	$1.7	$213.0	$143.9	$5.1	$0.0	$641.1
2005	$327.8	$143.6	$138.2	$1.0	$233.2	$428.5	$2.1	$0.0	$1,274.4
Total	$4,045.5	$1,698.2	$1,216.7	$73.1	$5,457.7	$3,107.6	$66.0	$0.0	15,664.7
Annual average	$202.3	$84.9	$60.8	$3.7	$272.9	$155.4	$3.3	$0.0	$783.2

[1] Records on crop base enrolled were not published after 1996 reenrolments. Base acres were assumed to have been reenroled after 1996

[2] Nonbase acres are valued at the average expenditure per acre of all program crops.

Table 4—Cropland and CRP by erodibility, 1982 and 1997

	1982			1997		
EI Level	Cropland	Later enrolled in CRP	Total	Cropland	Enrolled in CRP	Total
	thousand acres					
<8	283,120	15,534	298,654	272,931	14,036	286,967
8-15	64,219	9,508	73,726	62,363	10,154	72,516
>15	43,204	7,654	50,858	41,704	8,506	50,210
	390,542	32,696	423,238	376,998	32,696	409,694
	percent					
<8	66.9%	3.7%	70.6%	66.6%	3.4%	70.0%
8-15	15.2%	2.2%	17.4%	15.2%	2.5%	17.7%
>15	10.2%	1.8%	12.0%	10.2%	2.1%	12.3%
	92.3%	7.7%	100.0%	92.0%	8.0%	100.0%
	Sheet and rill erosion, tons					
<8	715,800,115	41,687,592	757,487,707	546,414,632	3,260,293	549,674,925
8-15	306,281,851	41,779,987	348,061,838	209,198,511	3,183,973	212,382,484
>15	489,539,854	94,799,976	584,339,830	300,098,973	5,845,693	305,944,666
	1,511,621,820	178,267,555	1,689,889,375	1,055,712,116	12,289,959	1,068,002,075
	Wind erosion, tons					
<8	526,467,722	44,392,366	570,860,088	374,625,441	1,155,020	375,780,461
8-15	322,081,620	68,567,545	390,649,165	231,370,901	2,247,473	233,618,374
>15	300,374,953	110,419,935	410,794,888	224,361,072	6,755,166	231,116,238
	1,148,924,295	223,379,845	1,372,304,141	830,357,415	10,157,659	840,515,074
	Sheet and rill erosion, percent					
<8	42.4%	2.5%	44.8%	51.2%	0.3%	51.5%
8-15	18.1%	2.5%	20.6%	19.6%	0.3%	19.9%
>15	29.0%	5.6%	34.6%	28.1%	0.5%	28.6%
	89.5%	10.5%	100.0%	98.8%	1.2%	100.0%
	Wind erosion, percent					
<8	38.4%	3.2%	41.6%	44.6%	0.1%	44.7%
8-15	23.5%	5.0%	28.5%	27.5%	0.3%	27.8%
>15	21.9%	8.0%	29.9%	26.7%	0.8%	27.5%
	83.7%	16.3%	100.0%	98.8%	1.2%	100.0%
Source: Agricultural Conservation Economics analysis of 1997 NRI data.						

Table 5—Reduction in sheet and rill and wind erosion with CRP, 1982-1997

	1982	1997	Change
CRP enrolment, thousand acres	0	32,696	-32,696
Sheet and rill erosion, tons	178,267,555	12,289,959	165,977,596
Wind erosion, tons	223,379,845	10,157,659	213,222,186
Total, tons	401,647,401	22,447,618	379,199,783
Sheet and rill erosion, percent	10.5%	1.2%	26.7%
Wind erosion, percent	16.3%	1.2%	40.1%
Total, percent	13.1%	1.2%	32.9%

Source: Agricultural Conservation Economics analysis of 1997 NRI data.

Sediment from water-born erosion is a major water pollutant in its own right, and often is the transport mechanism for phosphorus bound to soil particles. Economic benefits from reduced sediment deposited in waterways affect municipal water treatment facilities, marine and freshwater fisheries, navigation, flooding, industrial production, reservoirs, and water-based recreation. Estimates for damages from sediment in navigation channels, ditches, etc. and water-based recreation total $317 million per year, or $2.7 billion in NPV over 10 years at 3 percent (Feather et al., 1999). Applying these estimates per ton of sheet and rill erosion to the 1982-1997 sheet and rill erosion reductions for CRP yields an annual benefit of $543 million, or a net present value of $4.6 billion over 10 years at 3 percent (table 6).

None of these estimates explicitly factor in reductions in fertilizer use. I estimated fertilizer reductions from retiring cropland in CRP by applying the percentage of acres fertilized and the average rate during the period 1993-2003 by crop to the base acres of each crop retired in CRP (table 7). Nonbase acre fertilizer was assumed to be zero. Some 626,000 tons of nitrogen fertilizer and 227,000 tons of phosphate fertilizer were likely saved on cropland retired in CRP. This is 5-6 percent of average U.S. nitrogen and phosphate use in 1985-93 from retiring 8 percent of U.S. total cropland. Within the counties where CRP was retired, the reduction was about 6 percent of nitrogen used in 1976-85, and about 11 percent of the phosphate used. No estimate of the economic benefit from fertilizer reduction is available.

Table 6—Benefits of erosion reduction, Conservation Reserve Program

	Regionalized benefit coefficients 1/				1982-97 CRP erosion reductions		Aggregate benefit estimates			
Farm Production Region	**On site**	**Dust**	**Sediment**	**Total**	**Wind**	**SR**	**On site**	**Dust**	**Sediment**	**Total**
	Benefits ($/ton)				**Thousand tons**		**Benefits (million $)**			
Northeast	$1.67	$0.00	$13.33	$13.33	1.4	619.2	$1	$0	$8	$9
Lake States	$1.18	$0.00	$5.61	$3.17	12,357.2	8,713.6	$25	$0	$49	$74
Corn Belt	$1.01	$0.00	$3.59	$4.53	2,520.2	62,572.9	$66	$0	$225	$290
Northern Plains	$0.43	$0.65	$1.81	$1.35	43,417.8	27,493.0	$30	$28	$50	$108
Appalachia	$0.58	$0.00	$4.20	$4.78	0.2	11,537.9	$7	$0	$48	$55
Southeast	$0.49	$0.00	$3.77	$4.26	0.0	9,486.7	$5	$0	$36	$40
Delta	$0.43	$0.00	$4.35	$4.78	0.0	12,386.1	$5	$0	$54	$59
Southern Plains	$0.37	$0.38	$2.55	$1.05	95,623.9	8,558.6	$38	$36	$22	$96
Mountain	$0.27	$0.49	$1.54	$0.89	55,146.6	15,155.7	$19	$27	$23	$69
Pacific	$0.41	$1.13	$3.00	$2.05	4,155.0	9,453.9	$6	$5	$28	$39
U.S.Total	$0.55	$0.45	$3.56	$2.24	213,222.2	165,977.6	$202	$96	$543	$841

1/ Coefficients derived from Sullivan et al., 2004
Source: Agricultural Conservation Economics analysis of 1997 NRI data.

Table 7—Estimated fertilizer reductions on cropland retired in the Conservation Program

Crop	CRP enrolment	Effective fertilization rate [1]		Fertilizer reduced [2]	
		Nitrogen	Phosphate	Nitrogen	Phosphate
	Thousand acres	Pounds per acre		Tons	
Barley	2,833.50	31	12	43,962	16,419
Corn	4,293.20	101	38	222,874	83,240
Cotton	1,434.20	38	17	28,154	12,982
Oats	1,396.80	14	5	10,064	3,377
Peanuts	6.18	23	24	69	70
Rice	15.1	104	13	790	94
Sorghum	2,465.00	44	12	52,890	15,706
Wheat	10,833.50	48	16	267,097	94,925
Program crops	23,277.30	53	19	625,900	226,813
Nonbase	13,145.40	0	0	0	0
Total	36,422.70	34	12	625,900	226,813
Estimated use in CRP counties, average, 1976-85 [3]				10,034,420	2,082,563
Reduction as a percent				6.2%	10.9%
U.S. use, average, 1985-93 [4]				10,936,944	4,254,222
Reduction as a percent				5.7%	5.3%
U.S. use, 1985				11,492,600	4,657,600
U.S. use, 2003				11,991,200	4,271,400
Difference, 1985-2003				499	-386
Percent change, 1985-2003				4.3%	-8.3%

[1] Product of percent of acres fertilized and average fertilization rate (pounds per acre), based on NASS and ERS State and regional estimates, various years, divided by average true yield, times program yield of retired CRP acres.

[2] Effective fertilization rate times program base acres retired, times program payment yield, based on Osborn, *et al.* (1995). Average rate on base acres applied to nonbase acres.

[3] County fertilizer use estimates for counties in which CRP was enrolled, Alexander and Smith (1990).

[4] Average total use, Huang (2005).

Air Quality

In the context of agricultural production, negative externalities to air quality consist primarily of wind-born dust, wind-driven pesticides, and production of gases such as ammonia and nitrous oxides from confined livestock. CRP has only affected wind-born dust to any measurable degree. Ervin and Lee (1994) found that CRP enrolment around Lubbock, Texas, had a statistically significant effect on a wind-blown dust index derived from visibility data for 1947-91. Regressing CRP acreage and other variables on the dust index accounted for 57 percent of the variation in the index. The average reduction in blown dust per million hectares of additional CRP, based on relationships in the Lubbock area, was 1.4 kg/m^2 (6.24 tons/acre), declining from 3.4 kg/m^2 (15.17 tons/acre) for up to 5 million hectares (12.3 million acres), to 0.2 kg/m^2 for increases above 30 million hectares (74.1 million acres).

Benefits from reducing wind-borne dust are based on a survey of household cleaning and health costs in New Mexico (Huzar and Piper, 1986; Ribaudo, *et al.* 1990), amounting to a net present value over 10 years of $436-$520 million discounted at 3 percent. Using the estimates per ton of wind erosion, applied to the CRP wind erosion reduction for 1982-1997 gives an annual benefit of $96 million, and an NPV of $818 million over 10 years at 3 percent (table 6).

Positive Externalities Produced

Wildlife Habitat

One benefit category plainly recognized by proponents and opponents of CRP generally is increased wildlife habitat when cropland is restored to some more natural cover (Berner, 1989; Allen, 1994). There have been a large number of *ex-post* studies quantifying relationships between particular wildlife species and the presence, characteristics, and management of CRP cover (Hohman and Halloum, 2000; Haufler, 2005; WMI, 2001). Three broad categories of study can be distinguished: farm wildlife, grassland birds, and ducks and other waterfowl.

"Farm" Wildlife

CRP enrolment is generally good for common wildlife species typically found in landscapes dominated by cultivated cropland because CRP planting greatly increase the landscape diversity of typical monocultures of corn, soybeans or similar crops. Species benefiting include small mammals (fox, skunk, raccoon, and cottontail rabbit) and introduced game birds such as pheasant. Studies on mammals in Mid-Western CRP cover summarized in Farrand and Rayan (2005) show evidence of use by deer mice, white-footed mice, meadow voles and shrews. Larger species recorded were raccoon, striped skunk, marmot, and Virginia opossum. Swift foxes avoided CRP cover because the taller, denser vegetation reduced predation over alternative covers. Studies of white-tailed deer show that they used CRP land more-than-proportionally to its occurrence in spring and summer, periods of rapid vegetation growth and fawning. There is evidence of more abundant populations of rodent species in CRP cover than other land uses. There is some evidence for reproductive success and population growth for cottontail rabbit, negative correlation with jack rabbit, and little influence on white-tailed deer populations. While CRP may enhance habitat options for larger mammal species, it likely has little influence on overall populations.

In the Southeast, CRP covers encompass pine plantations, hardwoods and bottomland hardwoods, and grasslands (Berger, 2005). Evidence for grassland habitat is similar to that of the Mid-West, but rapid succession in pine and hardwood plantations means that the kinds and numbers of species using these habitats changes over time in predictable ways that can be influenced by mid-contract management.

FSA recently commissioned a study of relationships between CRP cover and pheasant numbers. The study concluded that "…there is an estimated 1.22 fold, or 22%, increase in ring-necked pheasant counts along a {breeding bird survey} BBS route associated with every increase of 319 ha (788 acres) of CRP herbaceous vegetation within a 1000 m buffer around the route. Three hundred nineteen ha is 4.05 % of an average buffer." (Nielson, et al., 2006).

Grassland Birds

Because much of the cultivated cropland added to the production base in the last 50 years came from pasture and range, these habitats and the grassland birds they support suffered population declines over this period (Johnson and Schwartz 1993, Hanowski 1995, Delisle and Savidge 1997, Horn 2000, Johnson and Igl 1995). Since CRP was mostly planted to grass, it should have resulted in improved habitat and increased numbers of these birds, all other things equal. There is ample evidence for this conclusion (Farrand and Ryan, 2005; Berger, 2005; Johnson, 2005; Johnson, 2000). Johnson (2005) concluded his review of the evidence by stating, "Conservation Reserve Program fields are clearly much more beneficial to a wide variety of breeding birds than are the cropland fields that they replaced. Tracts of untilled native prairie, however, are tremendously important to grassland birds."

Ducks and other waterfowl

CRP doesn't actively restore wetlands, but prairie pothole wetlands (shallow, seasonal wetlands that can persist in cropland fields) reassert themselves strongly when cultivated fields are retired to grassland cover in CRP. As the potholes re-emerge, the grass borders create prime nesting habitat for many "puddle" ducks. This has been particularly important in the Prairie Pothole region of North and South Dakota, western Minnesota, and eastern Montana, known as the continent's most important duck "factory" (Cowardin, et al., 1983).

Studies on duck production in the prairie pothole region showed that nest success on CRP land averaged 23 percent, higher than other land covers, and that 30 percent of the successful nests were on CRP land covering only 7 percent of land area (Reynolds, et al, 1996, 2001; Reynolds, 2005). Overall, duck productivity increased by 30 percent over what would have occurred without CRP, adding 12.4 million ducks, or a third of the entire U.S. duck harvest during 1992-97. This led to inclusion of the Prairie Pothole region as an additional National Conservation Priority Area in 1997, adding additional points on the EBI for enrolment in this area. FSA recently announced a new Conservation Reserve Program (CRP) Duck Nesting Habitat Initiative to increase duck populations by an estimated 60,000 birds annually and to restore 100,000 wetland acres (USDA, FSA, 2006 c). To date, about 1.9 million acres have been enrolled in wetland practices in the Prairie Pothole states and other states that make up the northern half of the Mississippi flyway, along with 14.6 million acres of grassland and other practices (figure 5). When these nesting and migratory stop over areas are combined with 117,000 acres of wetland practices in the southern states that provide wintering habitat for ducks, CRP has added significantly to waterfowl production in the Mississippi flyway. CRP has added wetlands and other practices for waterfowl habitat in the other major flyways, as well.

In the Prairie Pothole states, there is a clear correlation between duck (r^2 =0.71) and pond (r^2 =0.65) counts and CRP enrolment, lagged 5 years (figure 6). As CRP enrolment increased, pond sizes likely increased as water retention increased, and duck nesting success likely increased as CRP cover provided better nesting habitat around the emerging potholes.

The USDA cost/benefit assessment (USDA,FSA, 1996, 1997) valued increased consumptive and non-consumptive uses of wildlife ranging from $1.5-$2.0 billion. Feather and others (1999) found that annual additions to consumer surplus from

pheasant hunting on CRP land were $80.3 million, and from nonconsumptive wildlife viewing were $347.7 million. These estimates were expanded in Claassen and others (2001), who estimated benefits from wildlife habitat improvement of $704 million per year. These estimates are only partial, with significant categories of benefits not estimated (Hansen and Claassen, 2001).

Figure 5

Wetland and other CRP practices, by flyway, 2006

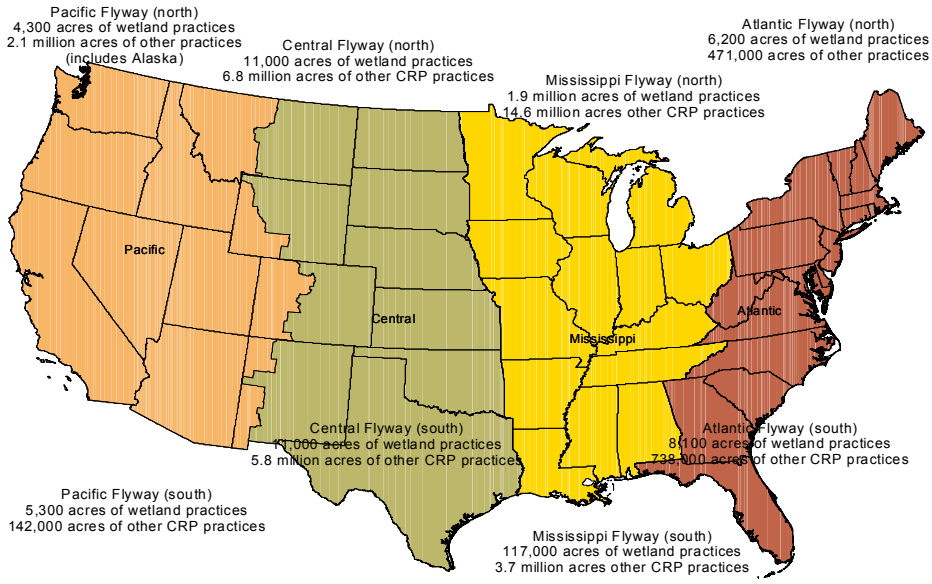
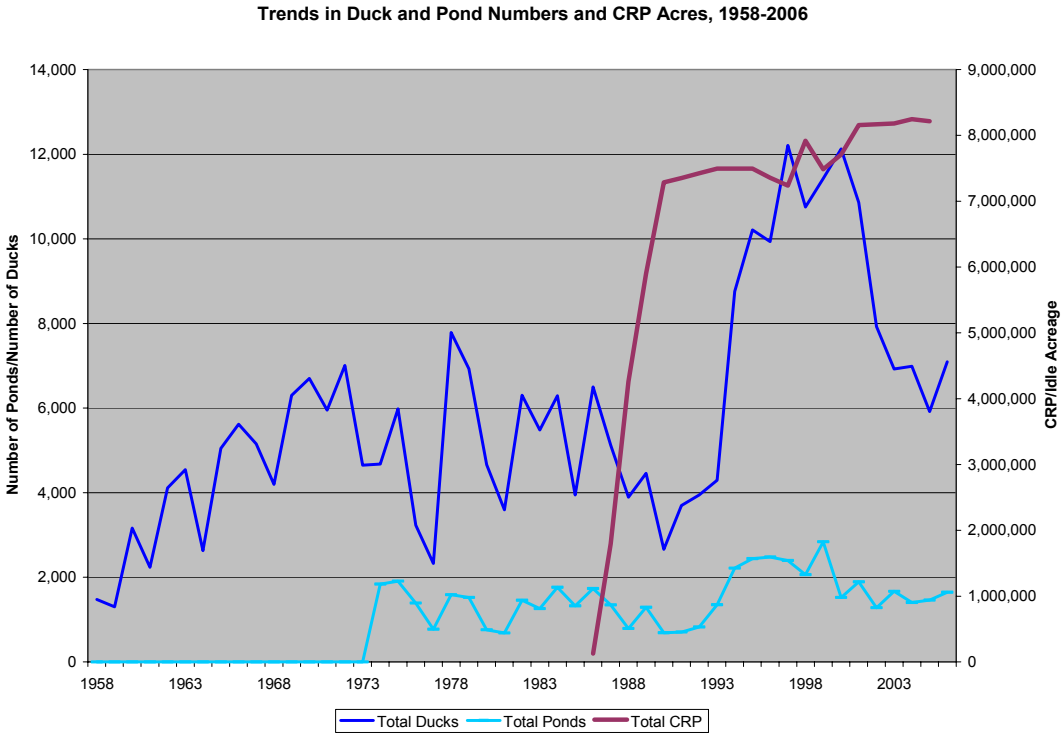


Figure 6



Carbon Sequestration

More carbon can be sequestered in CRP compared to continuous cultivated cropping (Lewandrowski, et al., 2004). Parks and Hardie (1995), Alig *et al.* (1997), Platinga *et al.* (1999), and Stavins (1999) estimated CRP-like schemes to convert land from crop production to trees, while Antle *et al.* (2001) and Pautsch *et al.* (2001) focused on conversion to grasslands. McCarl and Schneider (2001) and Lewandrowski *et al.* (2004) analyze more comprehensive schemes that consider both conversion to alternative covers, changes in agronomic practices, and charges for carbon emissions. One conclusion from all these studies is that the economic potential for sequestration from conversion of land covers is always less than the technical potential (115-242 million metric tons), represented by estimates made by Eve *et al.* (2000), Birdsey (1996), and Lal *et al.* (1998). Under provisions most like CRP (annual rental and cost-share for practices) and with prices per metric ton of carbon permanently sequestered ranging from $10 to $125, Lewandrowski *et al.* (2004) estimate that 8.4 to 133.6 million metric tons of carbon could be sequestered through land use change, almost all from afforestation.

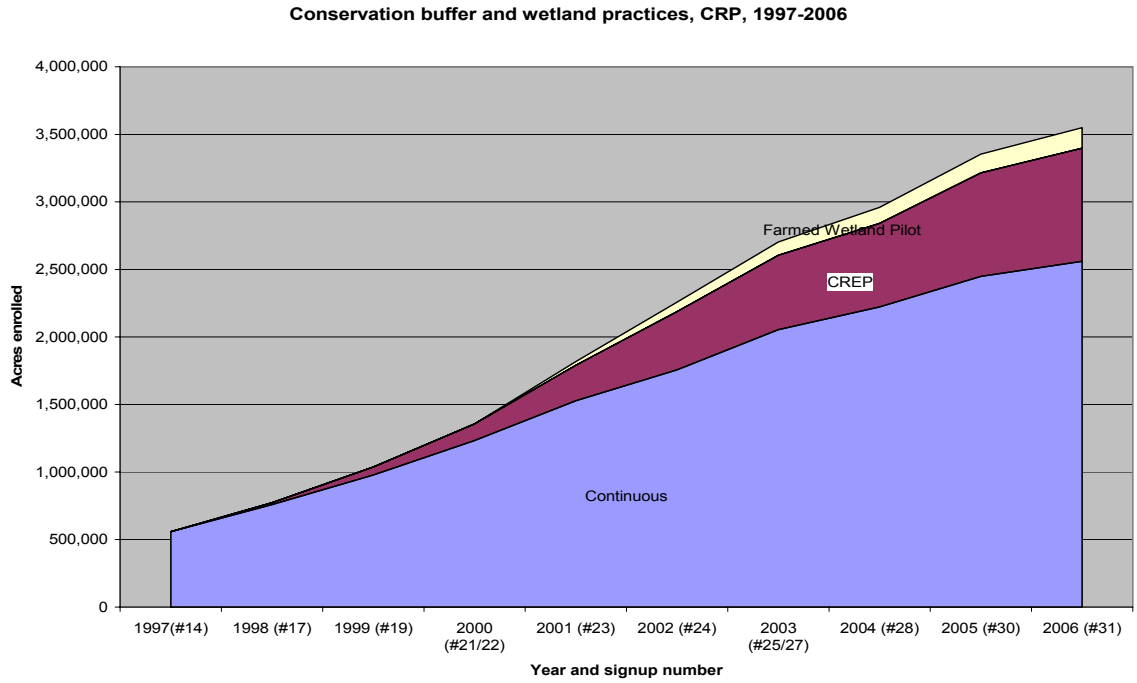
With relatively short (10 year) contracts, only limited interest in conversion to grassland for sequestration versus afforestation, limited functioning markets for sequestration, and great uncertainty regarding the pace, scope and damages associated with global warming, it is impossible to estimate the value of this potential benefit of CRP.

Pollutant Interception

CRP reduces pollution at its source by changing land use and cover, but pollution can also be reduced by buffers and wetlands along water courses that intercept pollutant flows. Whole field CRP enrolment accomplished some interception, but use of partial-field enrolments for conservation buffers and flood-plain wetland restoration in the continuous signup and CREP vastly increased buffer creation. Buffer practices increased from 557,000 acres enrolled in 1997 to 3.5 million acres in 2006 (Figure 7). Conservation buffers are 80 percent of the interception practices installed, with wetlands of different types making up the other 20 percent.

The effectiveness of conservation buffers and wetlands at intercepting surface and subsurface pollutants varies with the width, vegetation, and placement of the buffer, the nature of the pollutants flowing from upslope areas, and the variability, severity and seasonality of precipitation patterns (Klapproth and Johnson, 2000; DE DNREC, 2006; Mayer et al., 2005; Straughan Environmental, 2003; Wenger, 1999). There have been studies of ways to increase the cost-effectiveness of buffer installation through better targeting (Babcock et al., 1996; Yang and Weersink, 2004; Ferraro, 2000), but very few studies of the actual costs and benefits of riparian buffers (Holmes, et al., 2004). On a large scale, intercepting nonpoint source water pollution from agriculture was found to be a more cost-effective strategy than at source reduction to deal with nitrogen pollution contributing to the hypoxia issue in the Gulf of Mexico (Doering, *et al.* 1998; Ribaudo, *et al.* 2001). Conservation buffers can also have significant value for wildlife habitat improvement through use as movement corridors to connect patches of conserved or restored habitat. To be most effective, these corridors must be continuous.

Figure 7



Estimates of Economic Benefits

Modern CRP has been evaluated several times. A cost/benefit analysis of the 1985 CRP program conducted using benefits transfer methods after 26 million acres had been enrolled estimated that the full 45-million acre CRP would produce a net social benefit of $3.4 to 11 billion (Young and Osborn, 1990). Income gains to landowners were expected to be more than $13-26 billion, while benefits to natural resources and the environment were valued at only $5-12 billion (Ribaudo et al., 1990). Consumer costs were estimated to rise $13-25 billion, due to increased food prices related to reduced production.

When the CRP stood at 33.9 million acres, ERS estimated net social benefits of $4.2-$9 billion in present value over the life of the program (Osborn and Konyar, 1990). Benefits included increases in net farm income ($2.1-$6.3 billion), the value of future timber ($3.3 billion), preservation of soil productivity ($0.6-$1.7 billion), improved surface-water quality ($1.3-$4.2 billion), lower damages due to windblown dust ($0.3-$0.9 billion), and enhancements to wildlife ($1.9-$3.1billion). Social costs included higher food costs to consumers ($2.9-$7.8 billion), costs of establishing vegetative cover on CRP acres ($2.4 billion), and USDA technical assistance ($0.1 billion).

Under U.S. regulatory policy, the proposed rule implementing the reauthorized CRP after the 1996 FAIR Act was determined to be economically significant and was reviewed by the Office of Management and Budget (OMB) under Executive Order 12866. A benefit/cost and environmental risk assessment was conducted that analyzed the economic, environmental, and budgetary impacts of three alternative simulated CRP enrollment scenarios (USDA,FSA, 1996, 1997). While demurring any attempt at comprehensive estimation of CRP benefits, the assessment estimated soil productivity benefits ranging from $150-$195 million annually, water quality benefits ranging from $350-$455 million, and increased consumptive and non-consumptive

uses of wildlife ranging from $1.5-$2.0 billion, totaling $2.0-$2.7 billion per year for a partial accounting of the environmental benefits. Enrollment was expected to increase annual net farm income by $5.8-$7.6 billion. The net economic costs, summing the impacts on farm income, increased CRP outlays, and increased expenditures for a smaller quantity of commodities, ranged from $0.9-$1.5 billion per year.

A partial estimation of natural resource benefits from CRP land enrolled in 1992 was done by Feather and others (1999). They found that annual additions to consumer surplus from CRP in freshwater recreations were $35.4 million per year, from pheasant hunting on CRP land were $80.3 million, and from nonconsumptive wildlife viewing were $347.7 million (Feather et al., 1999). A change in the distribution of CRP enrollment corresponding to the changes that occurred with adopting the EBI was estimated to increase consumer surplus $370 million per year. These estimates were expanded in Claassen and others (2001), who estimated benefits from reduced soil erosion of $694 million per year, and from wildlife habitat improvement of $704 million per year. These estimates are only partial, with significant categories of benefits not estimated (Hansen and Claassen, 2001). Sullivan et al (2004) updated these various estimates to 2000 constant dollars.

Summarizing, the costs of CRP over 1985-2005, enumerated savings in government costs for commodity programs of $11 billion, is $10.7 billion (table 8). A partial accounting of estimated natural resources benefits totals $23 billion in net present value over the period, resulting in a net social benefit of $12.2 billion. This is a partial accounting because it does not estimate changes in farm income, consumer prices, or a variety of other benefits.

Table 8 Summary of costs and benefits, CRP, 1985-2005

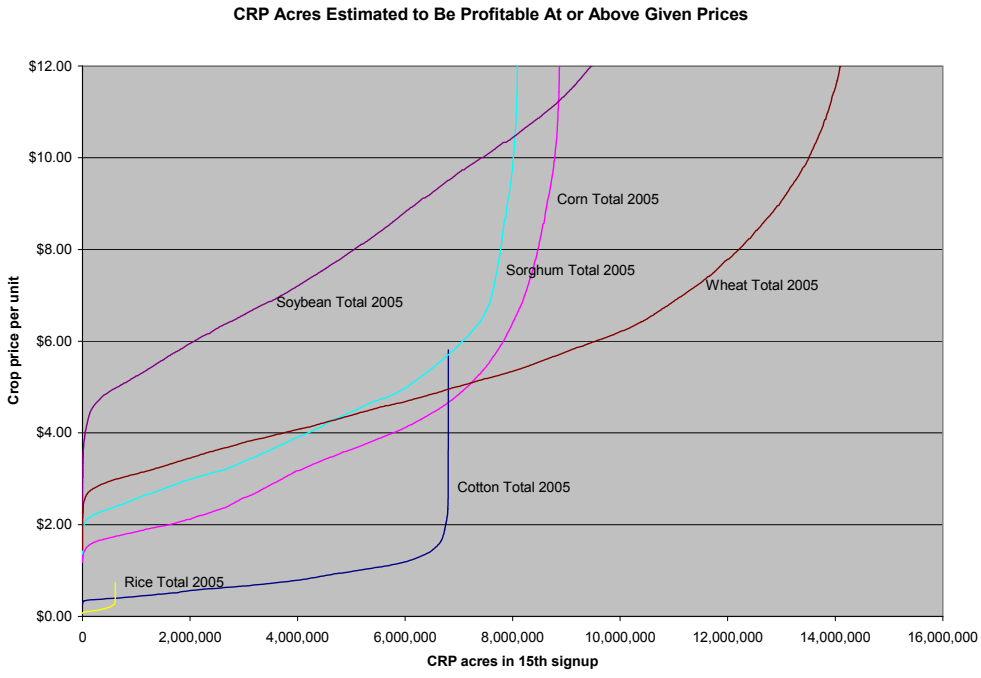
	1985-2005	
	Million dollars, undiscounted average per year	**Million dollars, NPV at 3% discount rate**
Direct costs (rent, incentives, establishment cost, technical assistance and administration)	$1,520	$21,799
Supply control savings	$783	$11,052
Net cost to the government	$736	$10,747
Soil productivity	$202	$3,003
Water quality	$543	$8,078
Wind-blown dust	$96	$1,427
Wildlife habitat	$704	$10,474
Partial natural resources subtotal	$1,545	$22,982
Net social benefit	$809	$12,235
Source: Agricultural Conservation Economics.		

Potential for Conversion of CRP to Cropland

For most of the time since 1985, there was little question that keeping land in CRP helped control commodity supplies and increase crop prices. However, in the last quarter of 2006, the price of corn shot up 50 percent to $3.12 per bushel, a price not seen since 1996. Futures prices for delivery in September, 2007, rose to $3.60 per bushel. After USDA announced a smaller-than-expected final corn crop estimate in January 2007, futures prices for March delivery reached $3.80 per bushel, and USDA's World Agricultural Outlook Board increased their price range for 2006/07 corn to $3-3.40 per bushel. Unlike recent previous corn price increases, this one is being driven not by supply shortages, but expectation of greatly increased demand for corn, primarily for ethanol production (Miranowski, 2007 in AEI volume). Corn producers and agribusiness leaders began to talk about shortages of corn to meet livestock feed demands, sources of new acreage for corn production, and the possibility of opening CRP acreage to corn production (Caldwell, 2006; NCGA, 2006; Collins, 2006).

How much more current CRP acreage would be profitable to crop at these prices? Prior to the increase in corn prices, USDA estimated that 4.3-7.2 million acres of CRP general signup in corn and soybean areas could be suitable for corn or soybean production (Collins, 2006). To account for the higher prices seen since then, I analyzed detailed parcel records for the 15th signup covering more than 16 million acres. Using the ratio of the state average rent to the CRP soil adjusted rental rate, yields for corn, wheat, soybeans, cotton, rice, and sorghum were estimated and used to estimate break-even net returns using regional costs of production (ERS citation). The resulting curves (figure 11) represent the amount of CRP acreage that would just be profitable to crop at the given price.

Figure 11



Crop futures prices for September 2007 delivery were applied to these data to calculate net returns to production, and the most profitable crop selected from those with positive net returns. In addition, the EBI scores and location in National Conservation Priority Area were examined to estimate what extension or renewal option would likely have been offered in FSA's recently completed REX process. More than 10 million of the 16 million acres in the 15th signup (63 percent) would be profitable to crop (table 9). Most of this (70 percent) would be in corn, and another 23 percent in wheat.

Table 9—Estimated 15th Signup CRP acres profitable to crop at futures crop prices

	Corn	Cotton	Rice	Sorghum	Soybeans	Wheat	Total
REX category[1]	Thousand acres						
2 year extension	2,336.8	2.4	1.4	1.6	37.5	270.8	2,650.5
3 year extension	1,603.8	2.4	7.6	60.1	93.5	454.7	2,222.2
4 year extension	1,052.7	13.7	7.0	48.4	112.6	671.9	1,906.3
5 year extension	1,163.9	15.5	11.4	68.2	171.3	568.3	1,998.5
10 year renewal	1,312.1	6.4	16.8	27.1	199.0	468.8	2,030.2
Total	7,469.3	40.4	44.1	205.4	613.9	2,434.6	10,807.7
Futures prices[2]	$3.60/bu	$0.555/lb	$10.32/cwt	$3.30/bu	$7.08/bu	$4.84/bu	na

[1] FSA's reenrollment and extension process divided CRP acreage expiring in 2007-2008 into 5 categories based on the EBI score assigned on enrollment and location in national conservation priority areas. The highest one-fifth of acreage ranked on this basis was offered a renewed 10-year contract, and each succeeding quintile offered extensions of 5, 4, 3,and 2 years.
[2] Futures prices on December 11, 2006 for delivery in September 2007.

Agro-energy is the early 21st century's equivalent of the Russian wheat deal: threatening to undo the last 20 years of conservation effort and unleash a new burst of "fencerow to fencerow" enthusiasm in America's heartland. Agro-energy production has been enticed into the market with a gradually increasing array of subsidies, crowned by the production mandate in the 2005 Energy Act (Duffield and Collins, 2006; Gielecki et al., 2001). Additional subsidies are being discussed as part of a potential energy title to the 2007 Farm Bill.

Alternative energy proponents have had their eye on CRP as a source of "free" land for over a decade, first because it was already subsidized by the government and could be "earmarked" for biomass production at low cost (Walsh et al., 1996; Graham et al., 1995). A pilot harvest project on CRP land was authorized in 2000 appropriations legislation (USDA, FSA 2000). More recently, as speculation about demand for alternative fuels soars, CRP offers a way to provide feedstock without stressing traditional markets for feed grain, sweeteners, and food (Walsh et al., 2003; Wu, 2004). Increased demand for corn from ethanol plants or soybeans from biodiesel plants could directly cause some owners of more productive CRP land located in proximity to new and existing plants to abort their CRP contracts (Hart, 2004; Wisner and Baumol, 2004a and b, Gallagher, 2006, Eidman, 2006). The rise in corn and other crop prices could provide an incentive for additional acres to leave their contracts. This would accelerate if Congress does not reauthorize CRP in the 2007 Farm Bill. Given that there is not yet a functioning prototype for cellulosic ethanol production, and the narrow geographic range over which hauling of these crops would be economical, the prospect of directly utilizing CRP cover crops seems an even more remote possibility, but CRP cover is being discussed for this use.

Environmentalists are somewhat conflicted over the prospects (OTA, 1993; Peelle, 2000). If CRP were in strong demand for alternative energy crops today, some would applaud the turn to renewable energy sources that could take pressure off vulnerable areas like the Alaska National Wildlife Refuge and reduce soil loss, nutrient use and pesticides relative to intensive crops. However, others would decry the destruction of wildlife habitat, the resumption of erosion, nutrient loss, and pesticide use, the loss of carbon sequestered in CRP trees and grass, and the diversion of corn and soybeans from the world's hungry to fuel SUVs. Cellulosic conversion offers more win-wins than corn and soybeans. The cellulosic crop of choice (switch grass) has clear soil erosion, water quality, and carbon sequestration benefits over intensive cultivation, but it is not a panacea for all wildlife habitat needs, and pressure to increase the harvested portion or frequency would stretch switchgrass's potential to both have the conservation "cake" and eat it too (McLaughlin and Walsh, 1998; Wu, 2004).

Lessons Learned From U.S. Land Retirement

A number of lessons have been learned from the long history of U.S. land retirement programs. The most important lessons concern targeting land retirement to increase the cost-effectiveness of the program, adjusting the payment to closely match the market value, setting appropriate terms for land conversion, and dealing with the issue of "slippage".

Targeting

CRP has become increasingly targeted on the benefits to be accomplished. From the 1930s through the 1960s, any land could be enrolled in CRP and predecessor programs. Modern CRP began with a broad goal of enrolling highly erodible cropland to reduce soil erosion. By 1990, however, it became clear that soil erosion itself was not as important a goal as had been previously thought. Physical and economic studies of erosion on crop productivity showed that onsite impacts paled in comparison with the impact of erosion and sedimentation on water quality, fish and wildlife habitat, and public services such as dams, ditches, and canals (USDA-SCS, 1981; Crosson and Stout, 1983; Larson, et al., 1983; Clark et al., 1985; Ribaudo, 1986; AAEA, 1986). These findings sparked growing interest in conservation policies that would mitigate the offsite impacts of erosion, and related nutrient and pesticide runoff (Ogg, et al., 1989). In addition, the importance of land retirement for creating and improving wildlife habitat associated with farmland, and the social and economic benefits people derived from these changes, prompted greater attention to these impacts (Berner, 1989; CAST, 1990; Allen, 1994). Finally, rebounding commodity prices blunted the desire to meet the 45-million acre enrollment goal, resulting in a 36 million acre enrollment cap in 1990 legislation. Enrolling the "best" acres (those with the highest environmental benefits per dollar spent) with the remaining acreage became more important than enrolling as many acres as possible.

In order to meet the multiple environmental objectives specified in 1990 farm legislation and to increase the cost-effectiveness of the program, USDA developed and instituted an Environmental Benefits Index (EBI) designed to proxy for the range of environmental benefits being sought (USDA,FSA, 2006 d, page A-21). A national cost-effective ranking based on the EBI score and offered rental rate was constructed

for each signup. Bids with the highest ratios were accepted until the acreage enrollment objectives for the signup were met. In 1996, when the 10-year contracts originally made in 1986 started to expire, CRP was reauthorized, and use of the EBI to ensure cost-effective enrollment was confirmed (The Federal Agriculture Improvement and Reform Act, P.L. 104-127, U.S.C. 7201). The EBI has been updated several times, with the latest version for the 33rd signup at USDA,FSA (2006a).

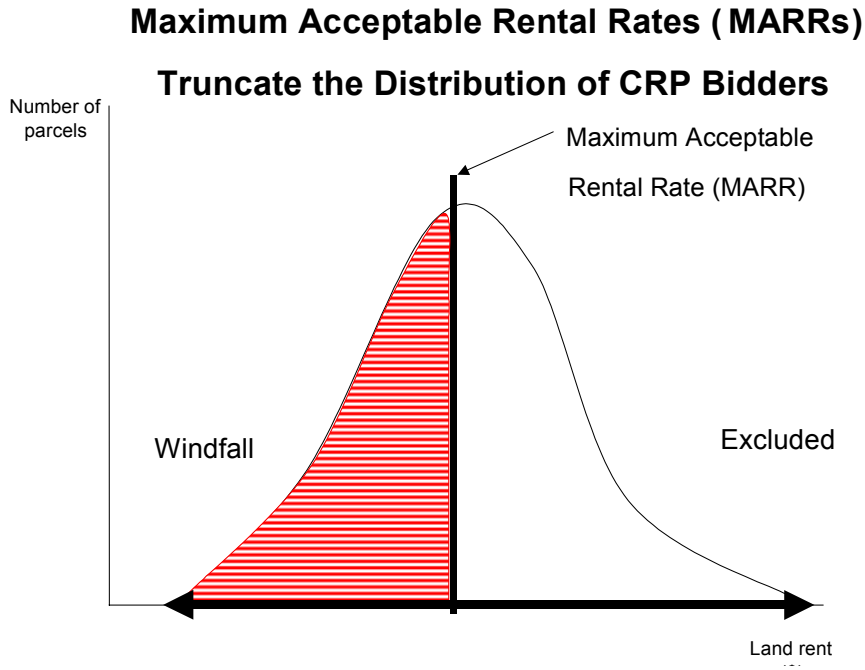
Getting the Rent Right

Compensating the farm operator for the opportunity cost of not using the land in crop production is the economic basis for all U.S. land retirement programs. In well-functioning, competitive markets, annual rents for agricultural land are theoretically equivalent to the annual returns from agricultural production, and hence equal the opportunity cost of using the land.

In theory, auctions could promote efficiency in running such a program (Boggess and Heady, 1981; Dicks, 1985; Ervin and Mill, 1985). Government and the farm operator could engage in bid/acceptance behavior that would let farmers offer land at a bid price, and government accept those bids it desired. In fact, an experimental bid program was conducted in 1958, but not continued (Christensen and Aines, 1962, p. 45). When the modern CRP was authorized in 1985, such a bid/acceptance process was implemented. The auction system failed for several reasons. Government officials suffered from asymmetric information: they were aware of average rent levels, but had little knowledge of the specific characteristics of individual parcels offered, which the farmers well knew. The sheer volume of offers overwhelmed local officials' ability to judge even appropriate rental rates, let alone the relative benefits offered by respective parcels. Some 65,000 contracts for 8 million acres were accepted in 3 signups in 1986 (Osborn *et al.* 1995). Officials sought assurance of the limits to acceptable bids. These Maximum Acceptable Rental Rates (MARRs), corresponding to average dryland cropland rental rates in multi-county areas, quickly became known and operated as a *de facto* offer system (Osborn, 1997). The 45 million-acre goal effectively precluded auctions because it was impossible to enroll that much acreage in a short period. Multiple enrollment periods and the obvious pressure government officials were under to enroll as much land as quickly as possible opened opportunities to "game" any bidding system in favor of the landowner.

The problem with the MARRs was that some parcels are more productive than others, as illustrated in figure 8. Underlying soil, topographic, microclimatic, parcel, and historic conditions dictate that different parcels have different productivity in crop production per acre, which can be represented by a statistical distribution (normal or log normal). If the MARR is set at the mean value of the distribution, it is only accurate for a relatively narrow band of parcels with values around the mean. For parcels with productivity lower than the mean, farm operators would be more than willing to enroll because rents higher than the opportunity cost of retiring land are being offered. For land with productivity higher than the mean, participation will never be attractive because the compensation offered is always lower than the opportunity cost. Raising the MARR above the mean rent would increase participation, but at the expense of offering "windfall" compensation to more landowners with land less productive than the MARR.

Figure 8



A soil-adjusted rental rate system was proposed that captured the essential elements of the distribution of soil productivity (Barbarika, et al., 1994). Average county rents are adjusted up and down in relation to the ratio of the parcel soil productivity to average productivity in the county. For example, a parcel with soil that is 20 percent more productive than the "average" soil in the county would get 1.2 times the average county rent.

Setting the Contract Term

Adjusting for inflation, the estimated total of payments for land retirement in CRP-like programs since 1933 is $48.7 billion in 2006 dollars. These payments compensated farm operators for giving up cropping use on 938 million acre-years (that is, an acre converted to conserving use for one year) over that period of time, resulting in an average real annual rental of $51.91 per acre. Capitalizing this rental amount in perpetuity at a real interest rate of 3 percent, yields a value per acre of $2,596, which is greater than or equal to the U.S. average 1996-97 cropland value of $1,270 per acre. The assertion that land repeatedly rented in 10-year contracts could have been bought as public land in 1996 when CRP was reauthorized is essentially correct.

Even if willing sellers for this land could be found, the Federal government has been reluctant to take public ownership of small, isolated parcels of what remains essentially farmland. The total costs to the Federal government of owning these parcels includes management, administrative, and enforcement costs, in addition to the acquisition cost. The parcels are generally too small and fragmented to be easily managed as wildlife refuges or parks, and may not have any unique or valuable ecological characteristics.

There is, however, another alternative to outright purchase that was not generally in use when Soil Bank or even modern CRP began. Permanent easements convey the right to intensively crop land in perpetuity, without restrictions on compatible use like

grazing or forestry, and retaining private ownership. Permanent easements face a number of difficulties that annual rental payments do not. The congressional budget process does not distinguish the up-front payment needed to purchase such rights from the year-by-year expense of a rental agreement in the way the two are scored for deficit reduction purposes. Because expenditures in out-years of the budget cycle do not count against deficit reduction caps, rental is preferred over appropriation of funds for permanent easements that must be paid in year 1. Second, there is a perception that farm landowners do not like permanent easements. Finally, permanent easements require periodic monitoring and enforcement to be effective. These activities are no more onerous for easements than for rental agreements over the same term. Monitoring easements can be subcontracted to interested third parties, such as NGOs or State agencies, which have an interest in the conservation outcomes and could provide the service for less cost than USDA staffing or a for-profit contract.

Slippage

Paying to retire highly erodible land from crop production becomes less effective if it causes equally erodible land to be brought into production. In 1987, there were 281.2 million acres of cropland harvested across the U.S., including 257.3 million acres in counties with CRP enrolment by 1997. Harvested cropland rose to 309.1 million acres in 1997, and then fell to 303.4 million acres by 2002. Only about 2.2 million acres of harvested cropland were added in counties that had no CRP in 1997, while those counties with CRP added an additional 20-25 million acres beyond the CRP land enrolled. CRP wasn't the only cropland retirement program in place in the early 1980s, however. ARP and PLD were still idling between 13 and 60 million acres between 1985 and 1995, peaking in 1987. Some of the increase in harvested cropland came from this source. Wu (2000) estimated that about 21 acres have been brought into crop production for every 100 retired through CRP. Roberts and Bucholtz (2005), using the same data, have found no evidence of slippage, suggesting that the magnitude of slippage remains an open question. Increases in production occurred at both the intensive and extensive margins since the land enrolled in CRP was generally less productive than the land that remained (Lubowski et al., 2006). The environmental impact of retiring this land was likely larger than indicated by sheer acreage alone, as well, since the same study found that CRP land was generally more erodible and more associated with endangered species.

Conservation compliance provisions of the 1985 Food Security Act (P.L. 99-198) were originally proposed as an alternative to another long-term land retirement program (Heimlich, 1985; Reichelderfer, 1985; Ogg and Zellner, 1984; Dinehardt and Libby, 1983), but have proven to be complimentary to CRP in preventing slippage. Compliance provisions require that farmers cannot continue to receive farm program benefits if they convert wetlands, convert highly erodible land, or continue to farm existing highly erodible fields, without a conservation plan that controls erosion (USDA, NRCS, 2006). Conservation compliance leverages the benefits of farm commodity programs, creating a powerful incentive for farmers to avoid converting highly erodible land, thus reducing incentives for slippage.

Any program of land retirement must consider some mechanism to discourage new land from entering production as existing cropland is retired. The mechanism can be regulatory, prohibiting new land conversion, quasi-regulatory, as the U.S.

conservation compliance provisions, or market-based, such as imposing significant taxes or fees on land conversion activity.

Considerations for the UK

CRP in the U.S. was motivated by an agricultural recession exacerbated by an excessive amount of highly erodible cropland that had recently entered production. Unlike the UK, wildlife in the U.S. is adapted to natural landscapes, not cultivated ones, so restoring those natural landscape covers benefits many species of wildlife. While there are some limited regulatory land use controls in urbanized areas, there are virtually no regulation affecting rural land, particularly agricultural use of rural land. To the extent that these conditions are not found in the UK, a CRP-like land retirement program may not be indicated.

If such a scheme is being considered, however, attention needs to be paid to the complete range of environmental benefits (and possible disbenefits) that accrue from retiring land from active cropping, rather than a single objective. Care needs to be exercised in differentiating the rents or easement payments on the basis of land productivity in use, rather than on the value of the benefits to be gained. Finally, mechanisms for insuring a permanent transition to less intensive use, and to preventing slippage along both production and environmental dimensions, need to be put in place to complement land retirement.

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Annex V: "BushTender" and "Auction for Landscape Recovery" case studies. By Uwe Latacz-Lohmann.

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1 Introduction

The recent promotion of auctions as a means to purchase environmental public goods from private landholders reflects the expectation that tendering mechanisms will perform better than the traditional fixed-price payment approach, where landholders are paid a predetermined fixed price for each unit of service supplied. The difficulty with the fixed-price approach is that the price can be fixed either too low, in which case too few landholders will participate, or too high, in which case lower-cost participants will be overcompensated, resulting in poor value for money for the government. Theoretical analysis suggests that competitive bidding can be a powerful means for conservation agencies to enhance the effectiveness of environmental service provision, for a number of reasons:

Budgetary cost-effectiveness:
An auction works on a competitive basis. Hence, some people 'miss out' on funding. This is the driver for competition which is necessary for an auction to work. Bidders facing competition are likely to bid close to their true costs of service provision. The expectation thus is that, compared to a fixed-price scheme, more environmental benefit can be purchased with the same amount of public money.

Economic cost-effectiveness:
Auction theory suggests that bids submitted by landholders are a function of the underlying costs of service provision: a higher cost is reflected in a higher bid. The bids thus provide an ordering of bidders by their underlying costs. Hence, accepting bids from the lowest upwards until the budget constraint is hit means granting conservation contracts to the most efficient service providers - those who can provide the contracted-for good or service at the lowest cost. A fixed-price scheme, by contrast, usually accepts applicants on a first-come, first-serve basis. If there happen to be many high-cost landholders among those who apply first, the outcome will not be cost-effective because many potential low-cost providers will have missed out on funding.

Price discovery:
Countryside benefits are public goods for which there are no markets. There is thus uncertainty about the value of the object being 'traded'. Holding an auction means that the better-informed party (the landholder) makes the first move in determining an appropriate price, while the less well-informed party (the conservation agency) retains the bargaining power by setting up rules under which the competing claims are compared and selected. Prices are determined through a decentralised market-like process which takes account of private information held by the bidders. Therefore, compared to a centrally decided, flat-rate payment, auction prices are more likely to reflect the landowners' true costs of service provision.

Fairness:
Tendering is perceived to be fair, which is politically important, making a transfer of public money legitimate. By holding an auction, the conservation agency avoids being confronted with questions about the level of pre-determined payments.
However, an auction is a complex incentive mechanism, involving a higher risk of failure than a simple fixed-rate payment. First, there is the potential problem of insufficient bidding competition. The smaller the group of potential bidders, the lower is the level of bidding competition and the higher the likelihood of collusion and strategic behaviour. Second, bidding involves the risk of learning on the part of the bidders. Experience with the Conservation Reserve Program in the US has shown that bidders tend to analyse the results of preceding bidding rounds and use this information to revise their bids upwards, eroding the cost-effectiveness benefit of the auction. Finally, auctions may involve higher transaction costs than fixed-price schemes. To the extent that these are upfront fixed costs, they may deter landholders from participating in the scheme.

The purpose of this report is to review the experience gained with two conservation pilot auctions carried out in Australia: the BushTender trial auction in the state of Victoria and the Auction for Landscape Recovery in Western Australia. Both pilot auctions were part of a larger national programme in Australia, aimed at trialling various market-based instruments (MBIs). The current interest in MBIs or market-like mechanisms arises from a concern of the Australian government that reliance on traditional policy approaches alone may be insufficient to achieve environmental objectives. Both auction trials were designed as field trials with a significant research component. For each auction, I will

- identify the key objectives or rationale;
- describe the operation of the policy in practice;
- review evidence of the scheme's effects and performance and any assessments or evaluations that have been made; and
- set out the major implications and lessons learned

The auction case studies are supplemented, in section 4, with a summary of an economic experiment designed to assess the cost-effectiveness of conservation auctions vis-à-vis equivalent fixed-rate payments. The purpose of this exercise is to put the findings from the Australian case studies into perspective.

The report concludes by highlighting the implications from the case studies and the auction experiment for the adoption of similar schemes in the context of EU agri-environmental policy.

Background and objectives

In 2001, the Victoria government (Australia) wanted to test the idea according to which auctions could efficiently purchase public environmental goods from private landholders. The good to be purchased was biodiversity as captured through improved 'bush' management. 'Bush' in Australia refers to the original deep rooted ligneous vegetation prior to clearing and farming, which in agricultural areas survives today usually in isolated patches. Under BushTender (BT), landholders competitively

tendered for contracts to enhance the native vegetation on their farms. Bids were selected on a value-for-money basis, with successful landholders receiving periodic payments for their management actions under agreements signed with the Victorian Department of Sustainability and Environment (DSE), formerly the Department of Natural Resources and Environment. The BT trials were conducted in two trial regions of Victoria.

Key objectives of the pilots were:

- to test the tender mechanism in terms of (a) its cost-effectiveness vis-à-vis a traditional fixed-price scheme; (b) its administrative feasibility and acceptance among landholders;
- to develop and apply a biodiversity benefit metric to measure improvements in biodiversity status;
- to test the effectiveness of management agreements (a novel approach in Australia) which stipulates management actions to achieve biodiversity outcomes.

Design and operation

Several micro-regions in Victoria were designated, and a budget (not counting administrative costs) of A$400,000 was allocated in a first round (2001) and A$800,000 in a second round (Gippsland trials, 2002-03). After initial publicity about the auction, expressions of interest were called for. Interested landholders were then visited by a field officer who assessed the quality and significance of the native vegetation on the site and discussed management options with the landholder. Landholders then identified the actions they proposed to undertake on the site and, with the field officer, prepared an agreed management plan as the basis of their bid. Following the site visit, landholders received a printed draft management plan. This contained some information about the relative conservation value of their site. Landholders then submitted their management plan along with a bid for payment to carry out the actions identified (Stoneham et al., 2003). Contract durations of 3 years were offered in round 1 and of 3 or 6 years (with a possible commitment of 10 years using covenants) in round 2 (Gippsland trial).

Each vegetation site offered into the auction was assessed based on significance of the vegetation type and the contribution to biodiversity status that would accrue from the proposed management actions. To this effect, ecological data were collected on these sites and analysed by scientists to devise a Biodiversity Benefits Index (BBI), defined as:

$$\text{Biodiversity Benefits Index} = \frac{\textit{Biodiversity Significance Score} \times \textit{Habitat Services Score}}{\textit{Cost announced by landholder } (= \textit{bid})}$$

This BBI defined a benefit-to-cost ratio for the government. The Biodiversity Significance Score (BSS) reflected the ecological value of the site, based on existing information about the scarcity of remnant vegetation types, according to Ecological Vegetation Classifications. The Habitat Services Score (HSS) measured the amount of biodiversity improvement offered by the landholder. In brief, it translates actions

proposed by landholders, such as fencing remnant vegetation or weed control, into a score reflecting the estimated improvement in biodiversity status.

A sealed-bid, discriminatory-price auction[19] was used to 'sell' the contracts to farmers and buy their pre-negotiated management commitments. Bids were ranked according to the BBI ratio, from highest value per dollar bid down, until the budget constraint was hit. No reserve price (maximum acceptable price per unit of service provided) was set *a priori*, because the pilot auction had a severe budget constraint which makes a reserve price less important.

In the first round, information was not given to farmers regarding their BBI, whereas it was given in the second round, mainly for (government) learning purposes. Between the two rounds, laboratory experiments were carried out to explore the effect of withholding or not such information from landholders. Effects on collusion and other bidding distortions were observed to be small in the lab (Cason et al., 2003).

Results

Table 1 summarises the main results. There was an acceptance rate of 97% of offered agreements by participants. In round 2, all but one landholder opted for a 6-year contract. Landholders demonstrated a strong preparedness to commit to a range of management actions, including stock exclusion, retaining trees and fallen timber and controlling weeds and introduced species (beyond current duty of care requirements). Fencing and supplementary planting recorded lower levels of uptake due to the site-specific nature of these actions. To date, only one landholder has not complied with his contractual agreements.

Budgetary cost-effectiveness:

The BT trial was the first pilot auction to test the proposition that competitive bidding, compared to fixed-rate payments, can significantly increase the cost-effectiveness of conservation contracting. Stoneham *et al.* (2005) analysed the bids of the first two bidding rounds and compared these to a hypothetical fixed-price scheme. Drawing on information from the bids, Figure 1 illustrates the cost (= bids) of generating additional units of biodiversity (measured as a biodiversity quality-adjusted unit, or BQ).[20] The curves thus represent the supply curves for biodiversity in a discriminatory first-price auction.

Based on these supply curves, Stoneham *et al.* (2005) computed the budget that a fixed-price scheme would have required to elicit the same quantity of BQ units as the BT auction. This was done by assuming that, in a fixed-price scheme, the conservation agency would pay each successful landholder the same price: the price of the highest successful bidder. The results are shown in Table 2.

[19] In a sealed-bid, discriminatory (first-price) auction, bids are submitted in sealed envelopes and then lowest bidders are accepted, receiving the payment stated in their bids. An alternative auction format is the uniform-price auction, where all successful bidders are paid the price of the lowest rejected bid, i.e. a uniform price – hence the name. The choice of auction format has implications for bidding behaviour, an issue I shall not dwell on in this report.

[20] These units are the numerator of the Biodiversity Benefits Index as explained above.

Table 1: Summary of BushTender results

BushTender	1st round (Northern VIC)	2nd round (Gippsland)	Total
Amount allocated	$400,000	$800,000	$1.2 m
Expressions of interest offered	126	101	227
No. of properties assessed	115 (91%)	68 (67%)	183
Sites assessed *	223	135	358
Bidders	98	51	149 (66% of EOI)
Successful bidders	73 (74%)	33 (65%)	106 (71%)
Habitat zones assessed**	357	276	633
Area under contract (ha)	3160	1684	4844 (63% high value)
Habitat area under contract (ha)			2876
Habitat gain accrual (ha)			414
Mean cost/ha under contract*** (excluding admin costs)	$126/ha	$475/ha	$248/ha

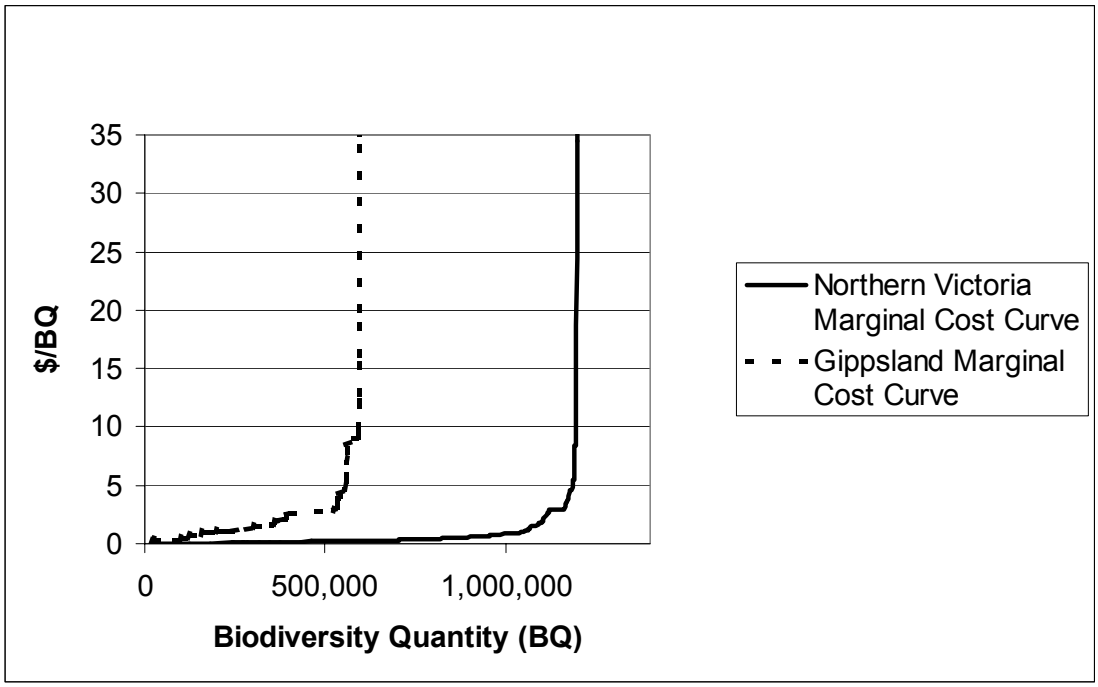
* *The number of sites assessed was greater than the number of properties as most properties offered more than one site.*

** *A habitat zone represents a unique Ecological Vegetation Class (EVC) / quality combination within a site.*

*** *Note that 1st round and 2nd round figures cannot be compared, as they relate to two different regions.*

Source: Latacz-Lohmann and Schilizzi (2005). Currency is in Australian dollars.

Figure 1: Bid curves from BushTender



Source: Stoneham et al., 2005

Table 2: Comparison of fixed-price scheme to BT auction[1]

		1st round (Northern VIC)	2nd round (Gippsland)
Comparison Holding Biodiversity quantity constant			
	Actual Budget ($US)	325,817	629,403
	Budget required in fixed-price scheme ($US)	2,113, 600	1,632,900
	Proportionate increase in cost of fixed price scheme	6.5	2.6
Comparison Holding Budget constant			
	Actual BQ	1,165,019	530,099
	BQ of fixed-price scheme	874,412	371,679
	Percentage fall in quantity from fixed-price scheme	25	30

[1] Note that currency here is in US $
Source: Stoneham *et al.* (2005)

According to Table 2, the amount of biodiversity benefits acquired through the first round of BushTender would have cost the government agency about six-and-a-half times as much if a fixed-price scheme had been used instead! For the second-round (Gippsland) trial, the claimed cost-effectiveness gain is 260%. Looked at it another way: for the same budget of around US$325,000, a fixed-price scheme would have given the agency approximately 25 per cent less biodiversity (see bottom part of Table

2). This discrepancy (650% versus 25% performance gain) clearly reflects the flat shape of the supply curve over much of the quantity range combined with the sharp increase of its slope as the quantity of BQ rises beyond a certain level (see Figure 1).

These results should be interpreted with caution. The suggestion here is that the size of the gain may be overstated due to an inappropriate counterfactual comparison. Stoneham *et al.* (2005) take the bid curve to be equal to the true opportunity cost curve. This is a wrong assumption because, in a discriminatory-price auction, bidders will shade their bids above their true opportunity costs. As a result, the opportunity cost curve remains unknown. Without knowledge of the underlying opportunity cost curve (which is the relevant supply curve in a fixed-price scheme) it is not possible to identify an appropriate counterfactual fixed price. Trying to compute cost-effectiveness gains without information on the cost structure therefore is an impossible task. I shall revisit this issue in section 4 where I shall discuss Stoneham et al's (2005) findings in the light of results from an economic experiment which compares the two mechanisms on an equal footing.

Administrative costs:
Transaction costs for the first round of BushTender, which included on-site research, ecological scoring and auction administration costs, amounted to roughly between 50% and 60% of the amount used in the auction. Falconer and Whitby (1999) report a variation in Europe of between 30% and 80%. It appears that such levels of transaction costs are to be expected as part of both the government agency's and the farmers' learning investment. They should diminish as they gain experience over time.

Lessons learned
Gary Stoneham, of the Department of Sustainability and Environment of the State of Victoria, and initiator of the BT trials, has been kind enough to share his views on what he believes his team has learned through the BT experience over the past four to five years. His views are valuable as he was directly involved in the development and the running of the BT trials. These are summarised in Box 1.

Box 1: Lessons learned from the BushTender pilots according to Gary Stoneham (personal communication, June 2005)

Lessons learned:

1. Auctions work - prices are discovered and contracts allocated.
2. They generate a marginal cost curve, information of value to government.(1)
3. They show improved cost-effectiveness over fixed-price schemes.
4. Collusion is a non-issue - we thought that this would be a problem to start with but we know that it is almost impossible to collude because bids are formed on an action basis but assessed on a service delivery relative to bid price.
5. We think that revelation of all information to landholders is best. In the first BT we only revealed some of the information about biodiversity service provision because we were worried about collusion. We now know that there is lots of economic surplus (or rent) and it is reasonable to share this between government and landholder. We would like to do some work on incentive compatible approaches to the distribution of rent.
6. Contract design is a big and relatively untouched area where there are lots of possible ways forward.
7. Auctions are popular with landholders: biodiversity is translated from a complex idea to practical actions.
8. We have had only one defaulting contract out of about 300 now.

(1) As explained above, the use of a discriminatory-price auction does not reveal the opportunity cost curve, as it is optimal for bidders to shade their bids. As a result, the cost curve remains unknown.

In addition, the following can be said:

- Carefully designed conservation auctions can work out in the field and yield non-negligible benefits, both in terms of ecology and in terms of budgetary outlays.
- The involvement of government officers and their dedication to explain to farmers the ins and outs of this new payment system are important for securing sufficient participation and thereby the level of competition necessary for the auction to play its efficiency role. The factors favouring and explaining landholder participation, or lack thereof, have been analysed by Ha *et al.* (2003).
- Field trials like BushTender have a learning function. They stand somewhere in between full scale policy implementation, like the Conservation Reserve Program which applied throughout the United States, and controlled laboratory experiments. In principle, the sequence running from theory to lab experiments to small scale field trials constitutes itself a learning process for full policy implementation.

BushTender today

Following the successful BT trials in Northern Victoria, BT has been implemented as a full-scale conservation scheme in the southern part of Victoria ("Southern Victoria BushTender") with an annual budget of A$500,000. The BT approach is targeted at improving the management of **existing** patches of native vegetation on private land. BT has been supplemented with CarbonTender, another auction-based incentive scheme targeting revegetation. The BT process has not changed much compared to the BT trials (Table 3).

Table 3: Synopsis of the Southern Victoria BT process

DEPARTMENT OF SUSTAINABILITY AND ENVIRONMENT (DSE) ROLE	LANDHOLDER ROLE
EXPRESSION OF INTEREST	
Provision of information to landholders in project areas A BushTender field officer contacts the landholder to arrange a site visit.	Landholders register an expression of interest through the DSE Customer Service Centre
SITE ASSESSMENT	
The field officer advises on the conservation values present at the site, assesses the quality of the native vegetation and discusses management and protection options with the landholder aimed at improving the quality of native vegetation on their land. The field officer scores the habitat improvement being offered by the landholder based on the discussed management actions and commitments.	
DEVELOPMENT OF A MANAGEMENT PLAN	
The field officer prepares a draft management plan based on the proposed landholder management actions and forwards this to the landholder for consideration. DSE also provides the landholder with a final assessment of their habitat improvement score and a summary of the conservation values of the site to assist with bid preparation.	
SUBMISSION OF BID	
	The landholder determines the payment they require for the proposed management actions and then submits a sealed bid for this amount.
BID ASSESSMENT	
DSE objectively assesses all bids on the basis of: ▪ current site conservation value; ▪ estimated improvement in vegetation condition and/or security offered; and, ▪ cost. → DSE notifies successful and unsuccessful bidders.	
MANAGEMENT AGREEMENT	
DSE and successful bidders sign fixed-term management agreements based on previously agreed management plans. Agreements with permanent protection are also available.	
UNSUCCESSFUL BIDDERS	
DSE informs unsuccessful bidders of the relative outcome of their bid in comparison to the general level at which bids were successful. These landholders will be provided with information on other regional programs that may assist them with management of their site.	
REPORTING AND PAYMENTS	
DSE forwards payment to signed-up landholders on receipt of an invoice. Payments occur subject to satisfactory progress against actions as specified in the agreement.	

Source: Southern Victoria BushTender Information Sheet No. 1

No evaluations are available as yet since this is a new programme.

Auction for Landscape Recovery (ALR) case study

Background and objectives

The Auction for Landscape Recovery (ALR) is a conservation auction pilot within the MBI pilot programme that builds upon experience gained with BushTender. Unlike BushTender, however, the ALR aimed at securing multiple benefits from land management improvements, namely biodiversity enhancement, salinity control, and groundwater recharge abatement (recharge compounds salinity). The ALR pilot was conducted in the north-eastern wheat belt of south-western Western Australia over two rounds. The region is part of the globally significant Southwest Australia Ecoregion, an area of high value due to exceptionally high terrestrial biodiversity and a correspondingly high degree of threat (Myers et al., 2000). Vegetation in the region is characterised by high levels of habitat loss and fragmentation due to clearing for agriculture and degradation due to ongoing threats such as weeds, grazing by livestock, and collection of firewood. Dryland salinity and associated water logging and inundation caused by rising groundwater tables are major threats to biodiversity values (Avon Catchment Council, 2004; Gole et al., 2005).

Land use within the region is largely confined to large farms focusing production on dryland agriculture and grazing. The region is one in which landholders work their properties as a full-time farm business. Located in the heart of the wheat belt, few landholders derive most of their income off-farm, and the number of 'lifestyle' landholders is negligible. It is within this economic context that the ALR provides a mechanism for the uptake of conservation management by landholders (Gole et al., 2005).

The ALR has been conducted as both an operational project intended to encourage the uptake of conservation management by landholders in the project region, and a field trial with proposed experimental and research outcomes. The project thus had both operational and research objectives. Specific pilot objectives for the ALR are (Gole et al., 2005):

- to test two alternative selection methods for assessing the relative benefits of individual actions by private landholders against quantitative biodiversity targets;
- to evaluate the minimum information needs for applying an auction approach to deliver natural resource management at a regional scale;
- to evaluate the relative benefits of a discriminatory-price auction versus a fixed-price scheme;
- to analyse administrative efficiency of a discriminatory-price auction versus fixed-price schemes;
- to analyse communication strategies with landholders;
- to identify and define the 'key success factors' and 'key impediments' for conservation auction schemes in Australia and the factors which are likely to be regionally sensitive; and
- to communicate pilot results.

Design and operation

The Avon River Catchment in the state of Western Australia was designated as the target area. As with BushTender, the programme was conducted over two rounds, in

2004-2005. Landholders could put up more than one bid each and were encouraged to put in joint bids for sites that offered synergetic conservation value.[21] Joint bids may involve proposals from two or more landholders who wish to manage a site that cuts across property boundaries, or multiple sites that are geographically close and would benefit from joint management. It was also possible for landholders to submit multiple bids for a single site: *i.e.* a suite of increasingly complex proposals or a series of sub-projects. Before the bids were put forward for evaluation, an independent group of experts reviewed the feasibility of projects submitted by landholders. Proposed projects required expert approval to ensure they could achieve stated outcomes. A total of A$200,000 was available for farmer payments, with A$93,000 spent in round 1, leaving A$107,000 for round 2.

The ALR was conducted as a simple sealed-bid price discriminating auction, similar to BushTender. Landholders who had expressed interest were encouraged to submit a tender describing their proposed management activities, anticipated environmental outcomes, and nominating the remuneration they required to undertake and complete on-ground works. The tender process was communicated as rewarding those who deliver the greatest environmental benefit per dollar. Producers were reminded that the scheme is competitive.

As with BushTender, the ALR operated on an 'inputs' rather than an 'outcomes' basis; *i.e.* contracts were phrased in terms of management actions with expected outcomes, and selection of bids was based on the expected outcomes arising from those actions. Management actions included, among other things, fencing and revegetation activities, earthworks to realign creeklines, divert surface water flow or mitigate salinity. Tenders were evaluated using a regional metric of 'biodiversity complementarity' (Faith and Walker, 1996) within a Systematic Conservation Planning Framework (Margules and Pressey, 2000). This metric, unlike the BBI, accounts for synergistic aspects due to number, size and distance of several sites; the BBI focuses on the individual value of each site. However, as part of the research project, an environmental benefits index (EBI) was also calculated, for comparability purposes with the 'biodiversity complementarity' score. Testing and comparing these two alternative biodiversity metrics was in fact a key research objective of the ALR pilot.

Biodiversity complementarity was assessed using *TARGET* software, which selected projects based on their complementarity gains in regional biodiversity. The *TARGET* software searches for combinations of projects that are within budget and maximise complementarity gains. A second review panel was convened to critique the results of the *TARGET* analysis, test for errors in the site assessment data and, where appropriate, iterate the selection procedure. Successful projects were selected within a budget of A$200,000 over two auction rounds.

Considerable emphasis was given to effective communication with the target group. Three documents were developed to this effect:

[21] Conservation synergies arise when the value of a conservation contract to the environmental agency increases if nearby lands are coming under conservation management at the same time.

- The Expression of Interest (EOI) form was the first formal point of contact between landholders and the project team. It captured the identities of landholders interested in engaging in the tender process and provided space for a brief statement of the proposed management actions, the size of the proposed site and the likely benefits from the tender.
- The Guidelines document was intended as the primary printed source of information on the project for landholders. It communicated the project's desired environmental outcomes, and emphasised the importance of public benefits, rather than private or production-based benefits. It also gave a basic introduction to the auction concept. It was anticipated that this information would be supplemented by additional support from the Community Support Officers when they made site visits.
- The Tender Submission Form elicited much of the information required to evaluate and rank bids, including site identification, details of proposed on-ground works and plans for long-term management, and the tender amount. Identifiers for joint or multiple tenders were also included. The document was supported by appropriate farm maps.

The idea of the ALR project as a novel conservation scheme was advertised widely through local press and radio, through contacts with local Community Landcare officers, and through personal contacts between Community Support Officers and landholders during informal community gatherings.

Results
In the first round (April 2004), a total of 55 bids were received from 38 landholders – some landholders putting in more than one bid. The second round (closing February 2005) generated 33 tenders from 21 landholders. Out of the 55 tenders submitted in round 1, a total of 10 were successful. In round 2, 13 tenders were accepted. These mainly offered to carry out fencing, revegetation and feral baiting. The relative weighting of these activities, implicit in the scoring method, was not known to bidders (Gole et al., 2005).

Outreach:
The ALR pilot was interested in whether an auction mechanism compared to conventional incentive schemes, would be able to extend landholder participation in the case study area. A survey of ALR participants and non-participants was carried out to establish whether the ALR had attracted landholders who had not previously participated in agri-environmental schemes or Landcare. The results suggest that the ALR has attracted, on average, the 'usual suspects', *i.e.* landholders who might normally be expected to participate in environmental schemes or Landcare-related activities. However the auction did also attract a number of landholders who had not previously participated in any other conservation scheme.

Budgetary cost effectiveness:
White and Burton (2005) used data from the ALR to benchmark the budgetary cost-effectiveness of the auction to that of a fixed-price scheme. They showed that the cost-effectiveness of the ALR compared to that of a uniform price scheme varies between 315% and 207% in round 1 and 165% and 186% in round 2, depending on the counterfactual fixed-price scheme selected. As noted above, making such cost-effectiveness comparisons is difficult in the absence of information about the

underlying opportunity cost curve. White and Burton (2005) address this problem by comparing the auction to a number of alternative fixed-price benchmark schemes (see Box 2) to gauge the range of potential cost-effectiveness gains. They suggest that the choice of an appropriate counterfactual fixed-price scheme should be guided largely by what is a pragmatic alternative. Table 3 shows the full results of these comparisons. It is clear from the table that the size of the cost-effectiveness gain depends critically upon the specification of the fixed-price contract and assumptions about the rent component of the bid. It is also clear from Table 3 that auction effectiveness can vary from round to round.

White and Burton (2005) also show that comparing BushTender to an output-based scheme (Contract 4 in Box 2) would considerably reduce the cost-effectiveness gains of 700% claimed by Stoneham *et al.* (2005).

Administrative costs:
About 70% of ALR costs were administrative costs, defined as all costs which are not payment transfers to farmers for on-ground works. They included all in-kind contributions, even if paid outside the project's budget. In addition, many costs were linked to the great distances involved and the remoteness of locations in rural Western Australia. Operational costs were estimated to total A$3291 per tender, split into A$1693 for variable costs and A$1598 for fixed costs (roughly a 50-50 split). These costs only reflect project establishment and running: they do not include compliance monitoring and contract enforcement. ALR administrative costs were incurred during five stages: scheme design, implementation, tender selection and evaluation. These stages appear to be common to most agri-environmental schemes (see Huylenbroeck and Whitby, 1999).

However, the amount available for payment transfers to farmers was only $200,000. It must be noted that the smaller the amount of transfer payments, the higher the proportion of administrative costs. This is a fixed-cost effect linked to the scale of the project. At the same time, such small-scale 'pilot' projects represent a learning investment with a significant research component. Under normal conditions the research component (including the communication and dissemination to the MBI pilot programme management process) would not have been undertaken.

Overall, there was no evidence to show that the ALR imposed higher administrative costs than equivalent fixed-price schemes using the same amount of information to underpin the selection process. This was because most of these costs were not linked to the specifics of running the auction.

Box 2: Alternative benchmark schemes for evaluating the cost-effectiveness of the ALR

Contract 1 is the **auction** itself where successful tenders are paid their bid in return for environmental inputs (discriminatory-price, budget-constrained auction).

Contract 2, is where a **fixed-price per unit of environmental benefit** is paid (Stoneham et al, 2003).

Contract 3 is where a **fixed-price per unit of environmental input** is applied, these payments ensure compliance by being greater than or equal to the bid. If the regulator is restricted to fixed price contracts, there is no guarantee that the optimal set of tenders selected from the price discriminating auction will be optimal. In other words, the regulator would make an alternative choice of successful bids if they were restricted to fixed output or input price contracts.

Contract 4 is where the regulator makes an **optimal selection of successful bids** and pays a **fixed-price per unit of environmental benefit**.

Contract 5 is where the regulator **selects bids** on the basis of fixed prices for environmental **inputs**.

Contract 6 assesses the gains from a partial price discrimination based on a fixed price for conservation inputs where the regulator divides the successful bids into **two groups with different payment rates** (**tiered contract scheme**).

Contracts 7 and 8 are environmental benefit and environmental input based schemes which account for the possibility that bids include an **element of rent**.

Source: White and Burton, 2005

Table 3: Cost-effectiveness of the ALR pilot auction assessed against different counterfactuals

					Transfer payments $:			
Contract	**Round**	**Total Cost $**	**EBI**	**Cost as per cent of Contract 1**	**EBI**	**Fence km**	**Revegetation ha**	**Feral control ha**
1. Discriminatory, budget-constrained auction (input-based)	1	99462	58540	100	-			
	2	98878	60854	100	-			
2. Fixed payment per unit of environmental benefit	1	313368	58540	315	5.353	-	-	-
	2	163129	60854	165	2.680	-	-	-
3. Fixed payments per unit of environmental input	1	206197	58540	207	-	3659.87	266.;66	0
	2	183672	60854	186	-	1888.89	874.87	0.453
4. Optimal fixed payment per unit of environmental benefit	1	313368	58540	315	5.353	-	-	-
	2	142207	61584	144	2.309			
5. Optimal fixed payments per unit of environmental input	1	206197	58540	207	-	3659.87	266.;66	0
	2	143327	60965	145	-	2329.41	198.71	0.88
6. Two-tier input pricing	1 tier 1 1 tier 2	148370	58566	149	-	3911.53 2212.92	37.88 266.67	0 0
	2 tier 1 2 tier 2	135348	60956	137	-	2207.09 1513.94	376.86 1.50	0.88 40.69

Source: White and Burton (2005)

Lessons learned

From some preliminary analyses carried out by White and Burton (2005) and the final report of the ALR pilots (Gole et al., 2005), some interesting observations emerge from this experience:

1) One of the key issues in the success of the project has been the support provided by Community Support Officers employed by the ALR. They assisted in attracting participants and supporting landholders through the tender submission process. The Community Support Officers also had a role in terms of engendering enthusiasm and providing inspiration to participants. This reinforces the experience with the BushTender pilots. There are important implications for this for similar projects elsewhere. The relatively high number of participants who had participated in previous incentive schemes suggests that a degree of human capacity or prior experience is required of participants. The ALR has obviously reached out to a number of landholders who had not previously participated, and an important aspect for consideration is how best to support those who may be attracted to the open tender process, but do not have the relevant prior experience.

2) Responses from the ALR landholder survey indicate that the three most effective means of communications was through local newsletters, the Community Landcare Coordinators and ALR Community Support Officers. These results suggest that locally-based information dissemination is an effective means for promoting the ALR.

3) Some confusion was caused by the word 'auction' in the context of a conservation funding scheme. Many landholders found the word a frustrating technical term that they did not find related, intuitively, to what they were required to do in order to participate. 'Auction' was considered a term commonly connected with land and house sales.

4) The building by natural scientists of a comprehensive scoring index for ranking multidimensional bids is an exercise fraught with pitfalls. Severe difficulty was experienced in moving from an inputs-based assessment process to a defensible predictive and probabilistic assessment of outcomes from given inputs. Subjectivity cannot be avoided, even if it is buried in the appearance of an objective measure (the scoring index). In particular, the relative weighting of different ecological benefits remains implicit and unknown to decision makers, and even to the scientists themselves if they do not have an explicit weighting procedure. If some of this information is to be communicated to farmers, it matters how this is done and how the information is to be interpreted.

5) Calculations done using bid data from the first round seem to show that a number of landholders bid below their opportunity costs (White and Burton, 2005). Follow-up interviews suggested that some of them would have carried out conservation works even without payment, raising the issue of the justification of using a payment scheme altogether. The implication seems to be that government should consider three categories of landholders: those who are ready to carry out conservation works with little or no payment; those who need to be paid at least their opportunity cost plus a rent; and those who will not enter into such agreements under any reasonable level of payment.

6) White and Burton (2005) conclude that "In general it is not possible to state if the uniform-price input scheme will generate lower or higher measures of cost-effectiveness for the auction: it appears to depend on the relative degree of heterogeneity in the opportunity costs, the environmental benefit, and the covariance between them." I would add: and the amount of bid shading.

7) Fixed-price schemes appear to be less vulnerable to rent-seeking than are auctions. In the ALR auction, there was evidence either of significant rent seeking or significant variations in the opportunity cost of service provision (most likely the former). This may become a problem if the auction has no tight budget constraint and no *a priori* reserve price is set.

8) As indicated above, there was no evidence to show that the auction imposed higher administrative costs than equivalent schemes using the same amount of information to underpin the selection process. Most of the administrative costs were not linked to the specifics of running an auction.

9) The relatively high 'fixed' cost component of the ALR (accounting for roughly 50 % of total admin costs) implies that any such scheme needs to operate at a sufficiently large scale so that the fixed costs of scheme administration can be efficiently distributed across a number of tenders.

Assessing auction performance: summary of an experimental study

Commenting on Stoneham et al's (2005) claimed cost-effectiveness gains of up to 650% compared to an equivalent fixed-price scheme, I argued that it is not possible to assess auction performance without knowledge of the underlying opportunity cost curve. It is important to understand in this context that the opportunity cost curve (representing the landholders' true costs of service provision) is the relevant supply curve when a fixed payment is offered. Then all landholders with opportunity costs below the fixed payment stand to gain from participation. The marginal participant is the one whose opportunity cost is equal to the payment rate offered. Auction field trials only reveal the bid curves (as the ones shown in Figure 1 for BushTender), not the opportunity cost curves, because a discriminatory-price auction leads bidders to shade their bids. The challenge facing authors like Stoneham *et al.* (2005) and White and Burton (2005) is that they have attempted an impossible task: to measure the performance of a discriminatory-price auction without knowledge of the bidders' underlying opportunity costs.

Schilizzi and Latacz-Lohmann (2006) carried out economic experiments to test the hypothesis that an auction is superior, in terms of cost-effectiveness, to a fixed-price incentive when compared on an equal footing. The great advantage of laboratory experiments is that bidders' opportunity costs are known to, and perfectly controlled for by, the experimenter. This enables an appropriate counterfactual fixed price scheme to be identified – a fixed-price scheme that would have yielded the same outcome as the auction or, alternatively, that would have resulted in the same budgetary outlay as the auction.

The experimental setup

The economic experiments were carried out with students in agricultural and resource economics at the University of Kiel, Germany, and at the University of Western Australia in Perth, Australia. The Perth experiment replicated the Kiel experiment in order to check for the robustness of results. Participants were offered would-be contracts for committing themselves to reduce applications of nitrogen fertilizer from their currently most profitable level down to a predefined constrained level. This was to reduce leaching and surface runoff. Each participant faced a different opportunity cost resulting from the adoption of the nitrogen reduction program. Costs were spread uniformly between €5 (the lowest-cost farmer) and €264 (the highest-cost farmer). Participants were told that not all of them would be able to win contracts within a tight budget and that they were therefore competing against each other. Three auction rounds were held in order to investigate the performance of the auction with repetition.

Auction formats and fixed-price counterfactuals

Two auction formats were tested: the budget-constrained (BC) auction and the target-constrained (TC) auction. In the first case, the budget is given and known; the risk is whether the enrolment target (as a measure of conservation quantity) will be achieved. In the second case, the target to be achieved is given and known; the risk is with what it might end up costing. For each of the two auction formats, an equivalent fixed payment was defined. For the BC auction, this was the minimum uniform payment rate that would have resulted in the same total expenditure as the auction. In the TC case, the corresponding uniform payment was computed as the minimum uniform payment that would have been needed to achieve the same outcome (conservation quantity) as the auction.

It is important to understand that the minimum uniform payment (MUP) benchmark is defined as the fixed-rate payment to the lowest-cost participants up to the budget or target constraint. That is, landholders are accepted into the scheme starting from the lowest opportunity costs until the budget is exhausted or the target is achieved. The MUP thus represents the lowest possible fixed-rate payment subject to the budget or target constraint. It thus provides a least-cost uniform pay rate, a theoretical but 'absolute' benchmark for comparison. Since this requires the knowledge of the opportunity cost curve, it is only possible in an experimental setting, not in a policy setting.

In practice, policy makers will not have this information, and the MUP will thus not be a realistic benchmark for policy settings. It is more realistic to assume that policy makers or administrators will have some information about the average opportunity costs of participation as an anchoring point or benchmark for choosing the payment rate. Schilizzi amd Latacz-Lohmann (2006) refer to this benchmark as the 'average cost payment' (ACP) benchmark as opposed to the more theoretical MUP.

Results

Table 1 presents the results so as to allow a direct assessment of auction performance relative to the two chosen FRP benchmarks: auction performance appears as 100% (of itself) while the MUP and ACP benchmarks are expressed in terms of the auction.

Table 4: Auction performance relative to the minimum uniform payment (MUP) and average cost payment (ACP) benchmarks (Auction = 100)

Performance criteria	Kiel experiment		Perth replicate		Auction type and round
	MUP	ACP	MUP	ACP	
Budget. cost-effectiveness (Payment / kg N abated)	111	131	129	158	BC 1
Rate of overcompensation (Total paymt / Opp Cost)	135	140	151	157	
Econ. cost-effectiveness (Opp Cost / kg N abated)	82	94	86	101	
Budget. cost-effectiveness	129	131	132	138	TC 1
Rate of overcompensation	136	136	129	130	
Econ. cost-effectiveness	94	97	100	106	
Budget. cost-effectiveness	98	116	106	133	BC 3
Rate of overcompensation	107	115	114	124	
Opp Cost / kg N abated	91	101	93	107	
Budget. cost-effectiveness	98	99	99	99	TC 3
Rate of overcompensation	100	104	104	104	
Econ. cost-effectiveness	98	96	95	95	

MUP: Minimum Uniform Payment rate (absolute benchmark)
ACP: Average Cost Payment rate
BC and TC: budget- and target-constrained auctions, rounds 1 and 3
Source: Schilizzi and Latacz-Lohmann (2006)

Table 4 shows that, in the first round of the auction, the auction outperforms fixed-price counterfactuals in terms of budgetary cost-effectiveness, as measured by the ratio of payment per kilogram of nitrogen abated. Relative to the MUP, this advantage ranges from 11 to 32 per cent, that is, one unit of abatement paid at a fixed rate would have cost 11 to 32 per cent more than the auction. Relative to the more policy relevant ACP benchmark, the range is, as one would expect, greater: 31 to 58 per cent. This performance advantage of the auction also holds in terms of information rents, indicated in Table 4 by the ratio of total payments to opportunity costs. For every € of opportunity cost, the MUP overcompensates landholders by 29 to 51 per cent more than the auction; the ACP overcompensates landholders' opportunity costs by 30 to 57 per cent more than the auction. In a one-shot auction setting, discriminatory-price bidding thus achieves a unit of abatement at least cost and minimizes the degree of overcompensation relative to the two FRP benchmarks.

Note that the cost-effectiveness gains of the auction are in a different order of magnitude than those claimed by Stoneham *et al.* (2005) for BushTender and White and Burton (2005) for the Auction for Landscape Recovery. The results shown in Table 4 are more in line with findings reported by CJC Consultants (2004) who evaluated the Scottish Challenge Fund scheme and found cost-effectiveness, compared to a fixed-price scheme, of 33 to 36%.[22]

[22] The Challenge Funds operated under the umbrella of the Woodland Grant Scheme (WGS) and offered additional grants to the standard WGS grants for extending the woodland area in specific

Another important conclusion emerges from Table 4: repetition erodes the advantage of auctions relative to fixed-price schemes. In round 3, both auction formats have lost their edge to the MUP, and the first-round results are mostly overturned. The TC auction has lost its advantage even to the ACP. Thus, with repetition, an auction loses its performance advantages over fixed-rate schemes; but the effect is only clear-cut in the TC case, where the auction clearly performs least well in terms of equivalent fixed-payment rates. In the BC case, this effect remains ambiguous. While the BC auction clearly performs less well in round 3 than in round 1, it maintains its advantage over its fixed-price benchmarks. This suggests that the auction is more robust to repetition under the BC setting than under the TC setting, a result of potential relevance to policy. These results confirm the experience from the US Conservation Reserve Program: when bidders have the opportunity to learn from preceding bidding rounds, they will use that information to update their bids and reap higher rents – at the detriment of auction performance (Reichelderfer and Boggess, 1988).

Policy conclusions

Some clear policy conclusions emerge from both the field pilots and the auction experiments.

- Conservation auctions perform better than fixed-price schemes only in a one-shot setting. Cost-effectiveness gains are more likely to be in the range of 10 to 60 per cent than 200 to 700 per cent as claimed by Stoneham *et al.* (2005).
- Repetition erodes the advantage of auctions relative to fixed-price schemes, making it easily possible for an auction to be outperformed by an equivalent fixed-rate incentive. When bidders have the opportunity to learn from previous results, they will use that information to revise their bids upwards at the detriment of auction performance.
- If the auction is to be repeated several times, which would likely be the case with most EU agri-environmental schemes, then one may hypothesise that changing one or more parameters of the auction would mitigate the erosion of the auction's advantage; for example, by announcing different reserve prices or changing the budget or the target level. The extent to which this would be true, however, is yet to be researched.
- The choice of auction format, budget-constrained or target-constrained, does not seem to matter very much. However, the budget-constrained (BC) auction appears to be more robust to bidder learning, which makes the BC the more appropriate format for repeated, multiple-signup agri-environmental schemes. In addition, BC is the more 'natural' format for agri-environmental management in the EU, where schemes usually have a limited budget and EU regulations limit the degree of overcompensation of farmers' opportunity costs.
- Running a conservation auction does not seem to involve excessively high administrative costs. BushTender (BT) and the Auction for Landscape Recovery (ALR) incurred admin costs in the range of 50 to 70% of the schemes' total costs. This seems to lie well within the range of admin costs observed for agri-environmental schemes in Europe (Falconer and Whitby,

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geographical areas. They were competitive in that applicants were required to submit bids to the Forestry Commission (FC) for this additional money.

1999). In addition, EU agri-environmental schemes will, on average, be operated at a larger scale than the two Australian pilots, so that the fixed costs of scheme administration can be distributed across a larger number of tenders.

- The switch from fixed-price incentive to discriminatory-price auction will normally involve more effort being placed on targeting conservation funds to areas and landholders with the highest benefit-to-cost ratio. This is done through appropriate bid selection procedures. To the extent that conservation benefits are difficult to quantify, subjectivity cannot be avoided in the bid selection process. Subjectivity is exacerbated when bids contains multiple environmental benefits, which must be aggregated into a single score for bid ranking. Subjectivity is likely to give rise to complaints and appeals from unsuccessful bidders, making the auction difficult and expensive to run, in comparison to a fixed-rate scheme with a simple first-come, first-serve rule.
- The involvement of government officers and Community Support Officers and their dedication to explain to landholders the new payment system have proved an important factor of success both in the BT and ALR trials. The same may be expected for any application of the auction approach in the context of EU agri-environmental policy. This calls for a broadly based implementation process – one that involves input from government agencies, environmental NGOs and other stakeholder groups.
- Experience with BT and ALR also suggests that an effective advertising and communication strategy is important for securing sufficient participation in the auction. In the Australian pilot auctions, locally-based information dissemination proved an effective means for promoting the auctions. It is not clear whether this would also be the case under EU circumstances, where farming communities are geographically less isolated than in Australia.
- In relation to publicising an auction-based conservation scheme, it seems important to avoid the use of the term 'auction'. As noted above, the term caused some confusion among landholders in the context of the ALR. Similar responses may be expected from target groups in the EU. Terms like 'tendering', 'competitive funding scheme', or 'discretionary payment scheme' are likely to be more acceptable.

Overall, I advise a cautious approach to the use of auctions in conservation contracting. Significant cost-effectiveness gains have been demonstrated only for the one-shot setting. With repetition, an auction quickly loses its edge over an equivalent fixed-price scheme. In addition, an auction is a complex incentive mechanism which involves a significant risk of failure. The implication for auctioning conservation contracts is that, given the insufficient guidance provided by theory and the paucity of practical experience, any policy initiative in this area should be preceded by carefully designed experiments and field trials. These are part of a learning process for full policy implementation. Laboratory experiments with stakeholders have potential advantages in terms of: eliciting the opportunity costs (and heterogeneity in costs) faced by landholders; identifying likely participation rates in an auction system, across different auction formats; and identifying the transaction costs associated with a tender mechanism. Field trials remain necessary to scope responses from landholders before full-scale policy implementation. The issue here is not whether lab experiments can predict outcomes in the field, or whether field trials can predict the outcomes of full-scale implementation. Lab experiments and field trials are important

because they allow policy makers and administrators to make all the important mistakes at low cost, before field implementation.

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