Provision of Public Goods through Agriculture in the European Union

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PROVISION OF PUBLIC GOODS THROUGH AGRICULTURE IN THE EUROPEAN UNION

30-CE-0233091/00-28

This study, financed by the Commission of the European Communities, has been carried out by the Institute for European Environmental Policy, and the consultant has full responsibility for the content. The conclusions, recommendations and opinions presented in this report reflect those of the consultant, and do not necessarily reflect the opinion of the Commission.

December 2009

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The report should be cited as follows:

Cooper, T., Hart, K. and Baldock, D. (2009) *The Provision of Public Goods Through Agriculture in the European Union,* Report Prepared for DG Agriculture and Rural Development, Contract No 30-CE-0233091/00-28, Institute for European Environmental Policy: London.

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ACKNOWLEDGEMENTS

This report draws extensively on the expertise and contributions of a large number of people. The authors would like to thank the following:

Bernhard Osterburg and Heike Nitsch (Johann Heinrich von Thünen-Institut) for their substantial contributions to a number of chapters and for their valuable support throughout the study.

Clunie Keenleyside (IEEP), Gwyn Jones (European Forum on Nature Conservation and Pastoralism), Dr Janet Dwyer and James Taylor (Countryside and Community Research Institute), Rico Hübner and Dr Jochen Kantelhardt (Technische Universität München) for their important contributions to individual chapters.

All case study partners, for collecting a large proportion of the empirical material upon which the analysis in the report rests:

Yann Desjeux, France.
Simone Schiller and Kerstin Hülemeyer, Institute for Rural Development Research, Germany.
Roberto Henke, Andrea Povellato, Maria Carmela and Macrì Francesco Vanni, Istituto Nazionale di Economia Agraria, Italy.
Dr Mark Redman, HighClere Consulting, Romania.
Mara Ruso, Institute for Agricultural Economics, Romania.
Jesús Barreiro, Hurlé José Gomez-Limon, Maria Anunciacion, Perez Bartolome Santiago Garcia and Fernández-Velilla, ITAGRA, Centro Tecnológico Agrario y Agroalimentario, Spain.
Knut Per Hasund, Sweden.
Jaroslav Prazan, Agricultural Institute for Agricultural Economics and Information, Czech Republic.
Clunie Keenleyside, Martin Farmer, Justin Bartley and Hannah Lee, IEEP, UK.

Hannah Lee, Håkon By, Sarah Gardner and Kathryn Arblaster (IEEP) for additional research support.

The experts who contributed to the scoring exercise that underpins part of the analysis in Chapter 3: Guy Beaufoy, Hans Brandt, Daniel Grima, Maria Luisa Paracchini, Philippe Pointereau, Jaroslav Prazan, Nigel Simpson and George Vlahos.

Member of the study's expert panel for their advice and valuable insights:

Professor Herve Guyomard	*INRA - Institut National de la Recherche Agronomique*
Professor Alois Heißenhuber	*TUM - Technische Universität München*
Professor Ian Hodge	*University of Cambridge*
Professor Karin Holm-Müller	*Rheinische Friedrich-Wilhelms-Universität*
Professor Ewa Rabinowicz	*SLI - Swedish Institute for Food and Agricultural Economics*
Professor Johan Swinnen	*Katholieke Universiteit Leuven*

Professor Allan Buckwell (Countryside Land and Business Association) for his ongoing intellectual engagement in the study.

Delphine Dubray for the French translation of the Executive Summary.

And finally, the authors are grateful for the support and encouragement of Christiane Canenbley, the Project Officer at DG Agriculture.

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LIST OF ABBREVIATIONS

AT	Austria
BE	Belgium
BG	Bulgaria
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
EL	Greece
ES	Spain
FI	Finland
FR	France
HU	Hungary
IE	Ireland
IT	Italy
LT	Lithuania
LU	Luxembourg
LV	Latvia
MT	Malta
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia
UK	United Kingdom

LIST OF ACRONYMS

AE	Agri-Environment
AoA	Agreement on Agriculture of the World Trade Organization
AONB	Area of Natural Beauty
BAP	Biodiversity Action Plan
CAP	Common Agricultural Policy
CBD	Convention on Biological Diversity
CE	Choice Experiment
CEC	Commission of the European Communities
CFC	Chloro-fluoro-carbon
CMEF	Common Monitoring and Evaluation Framework
COPI	Costs of Policy Inaction
CRP	Conservation Reserve Programme
CRoW	Countryside and Rights of Way Act
CV	Contingent Valuation
DEFRA	Department for Environment, Food and Rural Affairs (UK)
DG	Directorate General
DO	Denomination of Origins
DSO	Departmental Strategic Objective
EAAE	European Association of Agricultural Economists
EAFRD	European Agricultural Fund for Rural Development
ECA	Ecological Compensation Areas
ECA	European Court of Auditors
EEA	European Environment Agency
EEG	Erneuerbar-Energie-Gesetz
ELS	Entry Level Stewardship
EPA	Ecological Priority Area
EPA	Environment Protection Authority
EPEC	European Policy Evaluation Consortium
ESA	Environmentally Sensitive Area
ESU	Economic Size Unit
ETS	Emission Trading Scheme
EU	European Union
EU-12	The 12 Member States of the European Union
EU-15	The 15 Member States of the European Union
EU-27	All 27 Member States of the European Union
FAD	Filtration Avoidance Determination
FADN	Farm Accountancy Data Network
FAO	Food and Agriculture Organisation of the United Nations
FF	French Francs
FTE	Full-Time Equivalent
FSS	Farm Structure Survey
GAEC	Good Agricultural and Environmental Condition
GDR	German Democratic Republic
GFP	Good Farming Practice
GHG	Greenhouse Gas(es)
GIS	Geographical Information System
GM	Genetically Modified
HLS	Higher Level Stewardship
HMSO	Her Majesty's Stationery Office (UK)

HNV	High Nature Value
IPCC	Intergovernmental Panel on Climate Change
IRENA	Indicator Reporting on the Integration of Environmental concerns into Agriculture
LEAF	Linking Environment and Food
LFA	Less Favoured Area
LIFE	EU Financial Instrument for the Environment
LPA	Landscape Care Guidelines
LPO	French Bird Protection Association
LUC	Land Use Consultants
LUPG	Land Use Policy Group
MAFRD	Ministry for Agriculture Forestry and Rural Development (Romania)
MEKA	Marktentlastungs- und Kulturlandschaftsausgleich
MS	Member State
NABU	Nature and Biodiversity Conservation Union
NDA	Nitrogen Discharge Allowance
NECD	National Emissions Ceiling Directive
NGO	Non-Governmental Organisation
NMP	Nitrogen Management Plan
NVZ	Nitrate Vulnerable Zone
NYC	New York City
OECD	Organisation for Economic Co-operation and Development
OELS	Organic Entry Level Stewardship
PBR	Payment By Result
PDO	Potentially Damaging Operations
PDO	Protected Designation of Origin
PESERA	Pan-European Soil Erosion Risk Assessment
PHAE	Prime Herbagère Agri-Environnementale
PPP	Polluter Pays Principle
PGI	Protected Geographical Indication
PSA	Public Service Agreement
QE II	Queen Elizabeth II National Trust
RDP	Rural Development Plan
RISE	Rural Investment Support for Europe
RSPB	Royal Society for the Protection of Birds
SAC	Special Areas of Conservation
SAPARD	Special Accession Programme for Agriculture and Rural Development
SAPS	Single Area Payment Scheme
SCaMP	Sustainable Catchment Management Programme
SDAE	Severely Disadvantaged Areas of England
SDC	Sustainable Development Commission
SDS	Sustainable Development Strategy
SEBI	Streamlining European Biodiversity Indicators
SEK	Swedish Krona
SFP	Single Farm Payment
SPA	Special Protected Areas
SPS	Single Payment Scheme
SSSI	Sites of Special Scientific Interest
TEEB	The Economics of Ecosystems and Biodiversity
TPO	Tree Preservation Order
UAA	Utilised Agricultural Area

UNEP	United Nations Environment Programme
USA	United States of America
WTO	World Trade Organization
WTP	Willingness to pay
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

The purpose of this report is to examine the concept of public goods as it applies to agriculture in Europe and to assess how far there is a case for policy measures to encourage the provision of public goods by agriculture. The evidence draws on a wide range of secondary sources, including the literature, evaluation studies, an in-depth analysis of the policy framework, along with detailed information collected from eight regional case studies conducted in the Czech Republic, France, Germany, Italy, Romania, Spain, Sweden, and the UK between April and July 2009.

The Public Goods Concept

In Europe, agriculture has received a sustained level of public support over the last 50 years. Other productive sectors are not subject to public intervention on this scale, which raises the question as to why it continues to be required given the sector's increasing competitiveness and market orientation. In certain respects, agriculture is like other economic sectors, with a large number of producers participating in a range of markets for food, fibre, and raw materials for energy and industrial products. In other respects, it has specific characteristics which mean that the potential for the provision of public goods in the field of the environment is particularly prevalent in this sector. It is widely argued that securing the provision of public goods provides a valid reason for public intervention in a market economy.

The public goods concept is well established in economic theory which defines public goods by the following characteristics:

- Non-excludable – if the good is available to one person, others cannot be excluded from the benefits it confers.
- Non-rival – if the good is consumed by one person it does not reduce the amount available to others.

In reality, these characteristics of non-excludability and non-rivalry may be exhibited to almost any degree, and indeed pure public goods are rare. This is because the potential sometimes exists to exclude - often at considerable cost - people who do not contribute to covering the costs associated with the provision of a particular public good, and certain public goods, such as popular cultural landscapes, can become congested, leading to a loss of enjoyment. As such, any given public good can be situated along what may be described as a continuum of 'publicness'.

Given the defining characteristics of public goods, their supply cannot be secured through markets. This is because non-excludability and non-rivalry in consumption imply that users have no incentive to pay for public goods, often leading to over-exploitation. On the supply side, farmers have little incentive to provide public goods because they are not being paid to do so. In combination, these two factors explain the undersupply of public goods, and therefore, in the absence of functioning markets, public intervention is needed to achieve a desirable level of provision in line with societal demand. That said, public intervention is not always needed to secure the supply of public goods provided by agriculture. Certain quantities of public goods may be provided incidentally, as a side-effect of economically viable activities, or as a result of farmer altruism or self-interest.

To achieve a desirable level of public goods, policy actions are needed, unless demand is satisfied by incidental delivery. Where such actions go beyond the requirements set out in the legislative baseline, as enshrined in EU Directives, national legislation and in standards of good practice, they require payments to farmers for the delivery of public goods. Because a farmer holds the property rights and controls the factors of production, the most important of which is privately owned land, economic incentives are needed to encourage farmers to divert their means of production from the efficient production of farm commodities to the provision of public goods, which implies extra costs and / or income forgone. Thus, farmers need to be incentivised to pursue certain farming practices in order to maintain landscape features, restore and maintain specific habitats, or to manage natural resources such as water and soils, for example. In other words, society has to purchase what amounts to a reallocation of resources to underpin the provision of public goods.

The Main Public Goods Provided by Agriculture

There is a wide range of public goods associated with agriculture, many of which are highly valued by society. The most significant of these are environmental - such as agricultural landscapes, farmland biodiversity, water quality, water availability, soil functionality, climate stability (greenhouse gas emissions), climate stability (carbon storage), air quality, resilience to flooding and fire - as well as a diverse suite of more social public goods, including food security, rural vitality and farm animal welfare and health.

As discussed in Chapter 2 of the report, all share the characteristics of non-rivalry and non-excludability to varying degrees. Many are complex entities, with both public and private characteristics. Food security provides an example of a public good with distinct private characteristics. Although markets are the best regulators of food supply, there are hazards arising from a potential shortfall in supply that do not arise with other commodities less central to human welfare. Therefore, whilst the case for public intervention in relation to food security *per se* is small, ensuring access to affordable and safe food at all times warrants government action.

The study focuses on the ten main environmental public goods provided by agriculture. The reason for this focus is that there is evidence of the undersupply of these environmental public goods relative to the scale of societal demand and they have an important interaction with agriculture. This renders them a priority for public policy and the case for intervening at a European level through the CAP is strong.

The more social public goods provided through agriculture in Europe are not explored in the study, although further investigations to define them and their relationship with agriculture more precisely, to develop indicators to detect undersupply where it exists, and to assess the scale of public demand would be useful to inform future policy discussions.

Public Goods are Valued by the European Public

The study demonstrates that the European public places a high value on the environment. Attitudinal surveys indicate widespread concern for environmental issues - particularly with regard to biodiversity loss, the mitigation of climate change, water and air pollution, and the depletion of natural resources, including soils. In certain Member States, there is well documented demand for access to the countryside, protected areas and certain landscapes, as captured through the large numbers of visitors to National Parks and nature reserves, and a significant proportion of the population are members of environmental non-governmental organisations (NGOs). In addition, multiple studies have been conducted using contingent valuation techniques and other methodologies to assess social preferences for landscape and biodiversity, in particular. These reveal a wide range of positive values, including non-use values, and a hypothetical willingness to pay for certain environmental goods and services even though the individuals expressing these preferences may not be direct users of the goods in question. The collective values that society places on the environment are in turn reflected in political targets which specify a desired level of public good provision.

A Range of Socio-Economic Benefits Depend on the Existence of Certain Public Goods

In addition to the inherent value of public goods to society, a range of second order social and economic benefits occur that depend, partly or wholly, on the existence of the public goods provided through agriculture. The generation of these second order benefits highlights the importance of maintaining and enhancing the environment not only for its intrinsic value, but also for the potential role that it plays in stimulating economic activity in certain rural areas, thereby enhancing their vitality and the quality of life of those who live there, as well as of society more broadly.

There are multiple influences on the economic development of rural regions in Europe. However, the potential for a region to build on its environmental, social and cultural capital assets to derive an economic benefit is widely documented in the literature. In certain regions of Europe, attractive agricultural landscapes, the presence of farmland biodiversity and historical features provide economic opportunities for a variety of economic activities including rural tourism and recreation, speciality products and foods, as well as providing an attractive location for the establishment of businesses. Economic benefits of this kind are not confined to the more vibrant rural areas. The provision of public goods - such as the maintenance of farmland features, terraces and stone walls - provide economic and employment benefits for the farmer or for local contractors, as well as encouraging the retention of traditional skills. In addition, the products of certain environmentally sustainable farming systems have the potential to be differentiated on the basis of their association with particular production methods or settings, and thereby to attract a premium price.

The challenge of securing stewardship of this complex array of environmental, social and cultural assets in particular rural localities is to ensure that economic development unfurls in an environmentally sustainable manner. There appears to be a need not only for policy to encourage the provision of environmental public goods, but also for the policy framework to be sufficiently integrated to ensure that where social and economic synergies occur, they are promoted.

Certain Forms of Agricultural Management are Environmentally Beneficial

A wide variety of environmental public goods are provided by agriculture in the EU. Their distribution is not uniform across all forms of agricultural activity, nor is their provision constant over time. Certain characteristics of agriculture influence the degree to which public goods are provided, including: the agricultural land use; the practices applied and their sensitivity to the local environment; the farming systems being followed; the size and structure of the farm; and the agricultural infrastructure in a given locality, including patterns of drainage and irrigation.

The scale at which beneficial management is applied, as well as the presence of historical landscape features and the continuity of certain practices over time, has a considerable influence on environmental outcomes. This means that the provision of public goods will vary from farm to farm and between regions and climatic zones. Ultimately, however, the provision of any given public good will depend on a deliberate decision on the part of the farmer to allocate his / her factors of production and resources in an appropriate manner.

A review of the literature, coupled with an expert-led assessment of beneficial farming systems and practices conducted for this study, indicates that a number of farming systems and the practices employed within them are particularly important for the provision of public goods. These include more extensive livestock and mixed systems, the more traditional permanent crop systems, and organic systems.

The evidence also indicates that there is a large potential for highly productive farming systems to adopt environmentally beneficial production methods and thereby to provide public goods. There are three main clusters of farming practices that may be deployed to secure environmental benefits. These include the adoption of a suite of practices that are inherently less intrusive on the environment, specific practices which lead to improvements in energy efficiency and reductions in greenhouse gas emissions (typically associated with intensive livestock production); and more targeted practices that are designed to address a specific environmental concern, for example, the use of buffer strips or reduced tillage on arable farms.

The Need to Ensure the Continuation of Beneficial Management

Many of these beneficial forms of management are under threat. Market forces and technological advances continue to drive the search for efficiency gains stimulated by a growth in demand for food, bioenergy and other industrial products, coupled with pressures from the built environment. These changes are often paralleled by an increase in the opportunity costs of action in favour of the environment which are likely to be higher in the most productive agricultural areas. This implies higher payments under voluntary measures in such areas where there are compelling ecological reasons for interventions such as habitat creation, the retention and management of landscape features, or the adoption of lower input production methods.

In addition, the economic viability of agricultural production systems, such as extensive grazing, as well as those in naturally disadvantaged areas is in decline. Reduced viability is associated with a loss of traditional practices, diminished levels of active management, fewer livestock and outright abandonment in some places. Often this leads to a deterioration in the landscapes and the habitats essential for the survival of particular farmland species, and carries implications for soil and water quality. Support for the maintenance of these environmentally beneficial farming systems will be a critical component of the policy setting if the undersupply of public goods is to be addressed in a satisfactory way.

There is Evidence for the Undersupply of Public Goods

In assessing whether society's demand for public goods is being met, indicators provide a measure of the state of a given environmental medium. As such, they provide an indication of whether the supply of public goods associated with agriculture is sufficient. All of the 36 relevant EU-wide indicators suggest a situation of undersupply. There has been a deterioration in environmental state over time, with the exception of improvements in air quality, regional improvements in soil quality and a reduction in greenhouse gas emissions from agriculture. This situation is unsatisfactory and even where improvements have been made, there is clearly scope for further progress.

Specifically, individual indicators point to ongoing declines in the populations of farmland birds (although over the last decade, the situation has stabilised at the EU level), the poor conservation status of a majority of Natura 2000 sites, high rates of soil erosion by water and wind, a depletion in soil organic matter, the poor 'ecological status' of many water bodies resulting especially from diffuse pollution, high levels of water abstraction, particularly in water stressed areas, and a decline in the character of valued landscapes threatened by a loss of landscape elements, simplification and reduced management.

The evidence of undersupply is further substantiated by estimates of the monetary value of environmental goods and services and the cost of policy inaction. The few macro-level studies that have been undertaken indicate that these monetary values may be very large, and that the welfare losses associated with their degradation are of a similar magnitude. They suggest that society is systematically underestimating the scale of environmental degradation and that the cost of action to improve environmental delivery may be considerably less than the cost of inaction. These estimates provide an important stimulus to strengthen the actions and budgetary resources necessary to enhance the delivery of environmental public goods.

The Need for Public Intervention at the European Scale

On the basis of this evidence, there appears to be significant public interest in securing sustainable levels of environmental public goods provided by agriculture in the longer term. Government action is necessary to achieve this.

The most appropriate scale of intervention depends on a number of factors. Many of the public goods provided by agriculture, such as climate stability or biodiversity, are transboundary in character, whereas others, such as resilience to flooding or fire, may be defined as local or regional public goods. Whilst these characteristics exert some influence on the scale of intervention in line with the principles of subsidiarity and fiscal equivalence, there are a number of reasons for intervening at the European scale. Many of these public goods have a strong cross border element or are matters of EU common interest. As a result, securing their provision is an appropriate subject of EU policy.

Furthermore, financial solidarity in bearing the costs of providing public goods adheres to the principles of social and economic cohesion.

Setting Targets through the Political Process

Political decisions about the desirable level of provision of public goods should be made on the basis of a well founded understanding of societal demand. In recent years, the number of targets relating to the achievement of environmental outcomes has proliferated and the scale of ambition has increased. Targets set in relation to greenhouse gas emissions, soil quality, water quality and availability and resilience to flooding, in particular, have been added progressively alongside more established targets relating to species and habitats.

The Role of the CAP in the Provision of Public Goods

The CAP, with a budget of €53 billion per annum, exerts an important influence on agricultural land management in the EU and therefore has considerable potential to influence the scale of delivery of public goods. In addition to the CAP, dedicated funding for a range of public goods also exists but at a smaller scale, and is administered through the LIFE + programme, the Structural Funds, as well as specific national measures in all Member States.

Certain measures within the CAP, and most notably the agri-environment measure within Axis 2 of Rural Development policy, have explicit environmental objectives. Other Axis 2 measures can support environmentally sympathetic management on farms, such as those concerned with the LFA and Natura 2000 sites. Many of these measures have been shown to be targeted at a wide a range of public goods, with positive impacts.

There are other CAP measures, such as the decoupled direct payments under Pillar One of the CAP which make a substantial contribution to farm incomes. A large number of farms in receipt of these payments deliver public goods and certain of these may rely on these payments to maintain their economic viability, thereby enabling them to continue to provide public goods. Other farms in receipt of these payments, however, may not be providing public goods or may even be causing environmental degradation. Linking direct payments to standards of Good Agricultural and Environmental Condition (GAEC), therefore, contributes to providing basic levels of public goods. In addition, measures applied under Article 68 of Council Regulation 73/2009 may support either specific types of farming important for environmental protection or certain agricultural activities with environmental benefits.

The analysis suggests that the essential approach of pursuing environmental outcomes by combining cross compliance and incentive based measures over and above a regulatory baseline is an appropriate one. The combination of targeted measures applied under Rural Development policy and direct payments in association with cross compliance has brought environmental issues to farmers' attention in a much more prominent way, influenced a range of business and management decisions throughout Europe, helped to prevent abandonment on a significant scale, extended the application of a number of beneficial practices and contributed to the maintenance of more extensive and organic farms over a significant area.

Whilst there is evidence of undersupply in most of the key environmental public goods provided by agriculture, the current policy effort has been effective in stemming a trajectory of decline in several respects. In the face of pressures to concentrate and specialise production, to increase economies of scale and to maintain competitiveness, environmentally beneficial management practices have tended to be replaced by those that pursue efficiency gains, partly at the expense of the environment. Operating within the context of these broader economic forces, policy measures, such as the agri-environment measure, in many cases have had success in stemming the decline of beneficial management practices that might otherwise have been experienced.

That said, there are a number of reasons why the current policy framework has not achieved the improvement in the provision of public goods on the scale that is required. These relate to the relative weight afforded to the different objectives of policy, the choice of policy instruments, the design and subsequent implementation of policy measures, the extent of governance and institutional capacity and critically, the adequacy of budgetary resources. Indeed, current levels of expenditure on rural development measures with environmental objectives appear insufficient when compared to the scale of societal demand and estimates of the scale of funding required to meet EU targets for specific public goods.

Building on Experiences from Alternative Approaches

There is an ever-increasing need to improve the cost effectiveness of policy measures as well as to enhance the environmental outcomes delivered to secure larger cost-benefit gains. A range of approaches are either in use or are being piloted in the EU and further afield to encourage the provision of environmental public goods through agriculture. These include an exploration of ways to improve the cost effectiveness or enhance the environmental outcomes through the use of more competitive discretionary schemes, pilot schemes where payments are made on the basis of environmental outcomes, and the use of more collaborative approaches to delivery within a circumscribed territory. For the time being, these are mainly small-scale and pilot initiatives and their broader applicability outside of the specific contexts in which they are being applied is difficult to assess.

It will be desirable to build on the experience within the EU and in other countries to ensure that the policy response improves over time. However, none of the approaches examined appear to offer an alternative to agri-environment measures as the primary tool for delivering public goods through agriculture, and the programming approach which characterises Rural Development policy at the present time has clear strengths as a policy framework.

Identifying Future Policy Needs

In looking ahead over the next decade or more, changes in agricultural land use and management will alter the pattern of provision of public goods. The drivers of agricultural restructuring point to a diminution in the practices needed to provide these goods but there are also examples of trends in the other direction, such as increases in the energy efficiency of farming operations. That said, it seems likely that the incidental provision of environmental public goods by farmers will decline and additional demands will be made on policy interventions to address undersupply.

Policy intervention will be required across a large proportion of the farmed area, including the more intensive arable regions, to ensure the retention of soil functionality, the maintenance and improvement of water quality, reductions in greenhouse gas emissions, improved sequestration of carbon and enhanced resilience to flooding, as well as contributing to landscape and biodiversity goals. Alongside these interventions at the landscape scale, specific measures which are more precisely targeted in the locations where the supply of public goods is particularly concentrated, notably in the more extensively grazed areas, will also be critical.

Six Challenges for a Future EU Agricultural Policy

The need to provide public goods in Europe would be a valid and coherent justification for a future CAP. The challenge of encouraging this provision on the scale required to meet societal demand is considerable but the policy has several strengths for this purpose. The integration of the Göteborg principles on sustainable development into the CAP over the course of successive reforms provides sufficient scope for a wide range of policy actions affecting agriculture and environmental land management. In addition, the CAP provides a coherent European framework, taking account of common goals, the common market for agriculture and the need to maintain a broadly level playing field for farmers. It has the flexibility to take account of varying regional and national conditions without losing transparency if policies are well designed and administered.

Confronted with the challenge of addressing the undersupply of public goods, the CAP would need to retain a range of instruments capable of addressing the variety of agricultural conditions in Europe and the full suite of environmental public goods. Six key challenges can be identified if we look ahead towards a revision of the CAP in which the focus on the provision of environmental public goods is strengthened. These are:

- Giving more emphasis to the integration of environmental objectives at the heart of the policy: A consistent policy framework is needed to manage tensions in policy objectives and to ensure that an appropriate balance is struck between the economic, social and environmental dimensions of sustainable agriculture.

- Establishing appropriate targets: With a focus on environmental public goods, it will be important to establish clear targets for the full range of public goods that relevant policy measures are intended to deliver.

- Enhancing the effectiveness and efficiency of measures: Selecting the policy measures required to achieve these targets at a European level requires that due attention is given to the need for measures to be both effective and efficient.

- Improving implementation: The use of a range of policy measures in synergy can help to achieve better results. This requires a coordinated approach to scheme design and the fostering of increased institutional capacity at the Member State level, including the provision of advice and capacity building to farmers.

- Effective monitoring and evaluation: The monitoring and evaluation of the impacts of expenditure under the CAP is critical to ensure accountability and to allow for improvements to be made in terms of the design and targeting of support. The Common Monitoring and Evaluation Framework (CMEF) for Rural Development Policy provides a solid foundation in this respect.

- Securing sufficient budgetary resources: Calculations concerning funding requirements demonstrate the significant difference in the scale of funding estimated to be needed to achieve European environmental targets, and that currently available for those CAP measures targeted towards public good provision. Securing sufficient budgetary resources for supporting the provision of public goods would appear to be a clear priority for the future.

Competing Demands on Land Use in the EU

In addition to meeting society's requirements for environmental public goods there are competing demands on land use in Europe which are likely to be exacerbated in future. Potentially substantial changes in land management can be expected to arise from a variety of pressures, with increasing intensification and the growth of the area under arable production a likely impact of some of these trends. Many will be in direct conflict with the provision of public goods and thus contribute to an increased risk of undersupply in those situations where there is insufficient political intervention.

Given that land is a finite resource, the provision of public goods associated with land use should reflect the social optimum in Europe, both at the present time, and also take into account the needs and requirements of future generations. What is considered to be in society's best interest will reflect common objectives for food, the environment, bioenergy and social and economic cohesion, but it is essential that all of Europe's priorities are assessed in a strategic and integrated manner, with full consideration given to the trade-offs that achieving these objectives may imply. Finally, not all of Europe's broader requirements arising from agriculture are met by land managers within the EU, which relies heavily on imports of food and other bio-materials. This underscores the need to consider the global pattern of land use and agricultural activity when thinking about agriculture's role in providing society with a stream of both public and private goods.

RESUME

L'objet de ce rapport est d'examiner le concept de biens publics dans son application à l'agriculture en Europe et d'étudier dans quelles circonstances on a besoin de mesures de politique pour encourager la fourniture de biens publics par l'agriculture. Les éléments probants proviennent d'une large gamme de sources secondaires, notamment des publications, des études d'évaluation, une analyse en profondeur du cadre politique, ainsi que d'informations détaillées issues de huit études de cas régionales menées en République Tchèque, France, Allemagne, Italie, Roumanie, Espagne, Suède et au Royaume-Uni, entre avril et juillet 2009.

Le concept de biens publics

En Europe, au cours des 50 dernières années, l'agriculture a bénéficié d'un niveau soutenu d'aides publiques. D'autres secteurs de production ne sont pas sujets à une intervention publique de cette ampleur, ce qui soulève la question de savoir pourquoi elle continue à être nécessaire alors que le secteur est de plus en plus compétitif et adapté à la logique du marché. A certains égards l'agriculture est semblable à d'autres secteurs économiques, avec un grand nombre de producteurs actifs dans toute une gamme de marchés, pour la production alimentaire, les fibres et les matières premières pour produits énergétiques et industriels. A d'autres égards, elle présente des caractéristiques spécifiques qui font que le potentiel d'approvisionnement en biens publics environnementaux est particulièrement courant dans ce secteur. Il est largement argumenté qu'assurer l'approvisionnement en biens publics fournit une raison valable pour une intervention publique dans une économie de marché.

Le concept de biens publics est bien établi dans la théorie économique, qui définit les biens publics par les caractéristiques suivantes :

- Non-excluable – si le bien est disponible pour une personne, d'autres ne peuvent être exclues des bénéfices qu'il confère.
- Non-rival – si le bien est consommé par une personne, cela ne diminue pas la quantité disponible pour d'autres.

En réalité, les biens publics peuvent afficher ces caractéristiques de non-exclusion et de non-rivalité à presque tous les degrés et, de fait, des biens publics purs sont rares. Ceci tient au fait que la possibilité existe parfois

d’exclure - souvent à un coût considérable - des gens qui ne contribuent pas à couvrir les coûts associés à la fourniture d’un bien public particulier et que certains biens publics, tels que des paysages culturels populaires peuvent devenir excessivement fréquentés, ce qui aboutit à une moindre jouissance. De ce fait, tout bien public peut être positionné sur ce qui pourrait être décrit comme un continuum du “caractère public”.

Etant donné les caractéristiques qui définissent les biens publics, leur fourniture ne peut être assurée à travers un système de marchés. Ceci est dû au fait que la non-exclusion et la non-rivalité dans la consommation impliquent que les utilisateurs n’ont aucune motivation pour payer pour les biens publics, ce qui mène souvent à leur surexploitation. Du côté de l’offre, les agriculteurs ont peu de motivation à fournir des biens publics car ils ne sont pas payés pour le faire. La combinaison de ces deux facteurs explique le sous approvisionnement en biens publics et par conséquent, en l’absence de marchés qui fonctionnent, une intervention publique est nécessaire pour atteindre un niveau souhaitable de fourniture, en ligne avec la demande de la société. Ceci étant dit, une intervention publique n’est pas toujours nécessaire pour assurer l’approvisionnement en biens publics issus de l’agriculture. Une certaine quantité de biens publics peut être fournie incidemment, comme effet secondaire d’activités économiquement viables ou comme résultat de l’altruisme ou de l’intérêt personnel des agriculteurs.

Pour atteindre un niveau souhaitable d’approvisionnement en biens publics, des actions de politique sont nécessaires sauf si la demande est satisfaite incidemment. Lorsque de telles actions vont au-delà des exigences exposées dans le niveau de référence législatif tel qu’inscrit dans les Directives de l’UE, la législation nationale et les normes de bonne pratique, elles requièrent des paiements aux agriculteurs pour la fourniture de biens publics. Puisque les agriculteurs détiennent les droits de propriété et contrôlent les facteurs de production, le plus important d’entre eux étant les terres détenues de façon privée, des incitations financières sont nécessaires pour encourager les agriculteurs à réorienter leurs moyens de production d’une production performante de biens agricoles vers la fourniture de biens publics, ce qui implique des coûts supplémentaires et/ou une perte de revenus. Par conséquent, les agriculteurs doivent être incités financièrement à exercer certaines pratiques agricoles afin de préserver les éléments du paysage, restaurer et préserver des habitats spécifiques ou gérer les ressources naturelles telles que l’eau et les sols, par exemple. En d’autres termes, la société doit acheter ce qui revient à une réallocation des ressources à la base de la fourniture de biens publics.

Les principaux biens publics fournis par l'agriculture

Il existe une large gamme de biens publics associés à l'agriculture, beaucoup d'entre eux étant hautement appréciés par la société. Les plus significatifs sont environnementaux - tels que les paysages agricoles, la biodiversité en milieu agricole, la qualité de l'eau, la disponibilité en eau, les fonctions du sol, la stabilité du climat (émissions de gaz à effet de serre), la stabilité du climat (stockage du carbone), la qualité de l'air, la résilience aux inondations et aux feux – ainsi qu'une série diversifiée de biens publics à caractère plus social, y compris la sécurité alimentaire, la vitalité des zones rurales et le bien-être et la santé des animaux d'élevage.

Comme discuté dans le Chapitre 2 du rapport, tous partagent à des degrés divers les caractéristiques de non-rivalité et de non-exclusion. Beaucoup d'entre eux sont des entités complexes, ayant des caractéristiques à la fois publiques et privées. La sécurité alimentaire fournit un exemple de bien public présentant des caractéristiques privées distinctes. Bien que les marchés soient les meilleurs régulateurs de l'offre alimentaire, il y a des risques résultant d'une insuffisance potentielle de l'offre, qui ne se posent pas avec d'autres produits moins essentiels au bien-être humain. Par conséquent, bien que l'argument en faveur d'une intervention en relation avec la production alimentaire en tant que telle soit faible, assurer l'accès à des aliments abordables et sûrs en permanence justifie une action gouvernementale.

L'étude est essentiellement axée sur les dix principaux biens publics environnementaux fournis par l'agriculture. La raison de ce choix est le fait qu'il y a des preuves de sous approvisionnement de ces biens publics environnementaux par rapport à l'échelle de la demande de la société et qu'ils ont des interactions importantes avec l'agriculture. Ceci en fait une priorité de la politique publique et l'argument en faveur d'une intervention à un niveau européen à travers la PAC est fort.

Les biens publics de caractère plus social fournis à travers l'agriculture de l'UE ne sont pas explorés dans cette étude, bien que des investigations complémentaires pour définir plus précisément ces biens publics et leur relation avec l'agriculture, pour développer des indicateurs aptes à détecter un sous approvisionnement quand il existe et pour évaluer l'échelle de la demande publique seraient utiles pour éclairer les futures discussions de politique.

Les biens publics sont appréciés du public européen

L'étude démontre que le public européen attribue une haute valeur à l'environnement. Les enquêtes d'attitudes indiquent que les préoccupations d'ordre environnemental sont répandues – particulièrement en ce qui concerne la perte de biodiversité, l'atténuation du changement climatique, la pollution de l'eau et de l'air et la diminution des ressources naturelles, y compris les sols.

Dans certains états membres, il y a une demande bien documentée d'accès aux zones rurales, aux aires protégées et à certains paysages, comme le révèle le nombre élevé de visiteurs des parcs nationaux et réserves naturelles, et une part significative de la population adhère à des Organisations Non Gouvernementales (ONG) environnementales. En outre, de nombreuses études utilisant des techniques d'évaluation contingente et d'autres méthodes ont été menées pour évaluer les préférences sociales, particulièrement pour les paysages et la biodiversité. Elles mettent à jour une large gamme de valeurs positives, y compris des valeurs qui ne sont pas liées à l'usage, et une volonté hypothétique de payer pour certains biens et services environnementaux, alors même que les individus exprimant ces préférences ne sont pas toujours des utilisateurs directs des biens en question. Les valeurs collectives que la société attribue à l'environnement sont à leur tour reflétées dans les objectifs spécifiques politiques qui spécifient un niveau souhaité de fourniture d'un bien public.

Une gamme de bénéfices socio-économiques dépend de l'existence de certains biens publics

En plus de la valeur inhérente des biens publics pour la société, une gamme de bénéfices sociaux et économiques de second degré survient, qui dépend, partiellement ou totalement, de l'existence des biens publics fournis par l'agriculture. La génération de ces bénéfices de second degré met en évidence l'importance de la préservation ou de l'amélioration de l'environnement, non seulement pour sa valeur intrinsèque, mais aussi pour le rôle potentiel qu'il joue en stimulant l'activité économique dans certaines zones rurales, augmentant ainsi leur vitalité et la qualité de vie de ceux qui y vivent, ainsi que, plus généralement, de la société.

Les influences sur le développement économique des régions rurales en Europe sont multiples. Cependant, le potentiel pour une région à tirer parti de son capital environnemental, social et culturel pour en obtenir un bénéfice économique est largement documenté dans les publications. Dans certaines régions d'Europe, des paysages agricoles attractifs, la présence de biodiversité en milieu agricole et d'éléments historiques procurent des opportunités économiques pour un éventail d'activités économiques dont le tourisme rural et les loisirs, les produits et aliments de spécialité, et fournissent aussi une localisation attractive pour l'établissement d'entreprises. Les bénéfices économiques de ce genre ne sont pas limités aux zones rurales les plus dynamiques. La fourniture de biens publics - tels que la préservation des éléments du paysage agricole, des terrasses et des murs en pierre – procure des bénéfices économiques et en matière d'emploi aux agriculteurs ou aux prestataires locaux, tout en encourageant la sauvegarde des savoir-faire traditionnels. De plus, les produits de certains systèmes agricoles durables d'un point de vue environnemental ont le potentiel d'être différenciés du fait de leur association avec des méthodes ou un cadre de production particuliers et de justifier, sur cette base, un prix plus élevé.

Le défi que pose la mise en place de la gestion d'un tel ensemble complexe d'atouts environnementaux, sociaux et culturels dans des localités rurales particulières consiste à garantir que le développement économique se déroule d'une manière durable du point de vue environnemental. Il semble qu'il y ait besoin non seulement que la politique encourage la fourniture des biens publics environnementaux, mais aussi que le cadre politique soit suffisamment intégré pour garantir que là où des synergies sociales et économiques se présentent, elles sont favorisées.

Certaines formes de gestion agricole sont bénéfiques à l'environnement

Une grande variété de biens publics environnementaux est fournie par l'agriculture dans l'UE. Leur distribution n'est pas homogène à travers toutes les formes d'activité agricole, et leur approvisionnement n'est pas non plus constant dans le temps. Certaines caractéristiques de l'agriculture influencent le niveau auquel les biens publics sont fournis, y compris : l'utilisation agricole des terres, les pratiques employées et leur adéquation harmonieuse à l'environnement local, les systèmes agricoles qui sont suivis, la taille et la structure de l'exploitation agricole et l'infrastructure agricole dans une localité donnée, y compris les modes de drainage et d'irrigation.

L'échelle à laquelle la gestion bénéfique est appliquée, de même que la présence d'éléments historiques du paysage et la continuité dans le temps de certaines pratiques, ont une influence considérable sur les résultats environnementaux. Ceci signifie que la fourniture de biens publics variera d'une exploitation agricole à une autre et entre régions et zones climatiques. Cependant, en dernier ressort, la fourniture d'un bien public donné dépendra d'une décision délibérée de la part de l'agricultrice/agriculteur de réallouer ses facteurs de production et ressources d'une manière appropriée.

Une revue des publications, ajoutée à une analyse des systèmes et pratiques agricoles bénéfiques menée par des experts pour cette étude, indique qu'un certain nombre de systèmes et pratiques agricoles employés sont particulièrement importants pour la fourniture de biens publics. Ils incluent des systèmes plus extensifs d'élevage et d'agriculture mixte, les systèmes plus traditionnels de culture continue et les systèmes d'agriculture biologique.

Les éléments probants indiquent également qu'il existe un fort potentiel pour que des systèmes agricoles hautement productifs adoptent des méthodes de production bénéfiques à l'environnement et fournissent ainsi des biens publics. Il y a trois groupes principaux de pratiques agricoles qui peuvent être déployées pour obtenir des bénéfices environnementaux. Ceux-ci incluent l'adoption d'une série de pratiques qui sont, de façon inhérente, moins intrusives sur l'environnement; des pratiques spécifiques, qui mènent à une amélioration de l'efficacité énergétique et une réduction des émissions de gaz à effet de serre (typiquement associées à l'élevage intensif) ; et des pratiques plus ciblées qui sont conçues pour traiter une préoccupation environnementale spécifique, par exemple l'utilisation de bandes tampons ou une réduction du labour dans les exploitations céréalières.

Le besoin de garantir une continuation de la gestion bénéfique

Beaucoup de ces formes bénéfiques de gestion sont menacées. Les forces du marché et les avancées technologiques continuent de conduire la recherche de gains d'efficacité, stimulée par l'accroissement de la demande pour les produits alimentaires, bioénergétiques et autres produits industriels, qui s'ajoute aux pressions de l'environnement construit. Ces changements sont souvent accompagnés d'une augmentation des coûts d'opportunité des actions en faveur de l'environnement qui sont susceptibles d'être plus élevés dans les zones agricoles les plus productives. Ceci implique des paiements plus élevés dans le cadre des mesures volontaires dans les zones où il y a des raisons écologiques importantes pour des interventions, telles que la création d'habitat, le maintien et la gestion d'éléments du paysage ou l'adoption de méthodes de production à plus faibles intrants.

De plus, la viabilité économique des systèmes de production agricole, tels que le pastoralisme extensif, de même que de ceux des zones naturellement désavantagées, est en déclin. Une viabilité réduite est associée à une perte des pratiques traditionnelles, de moindres niveaux de gestion active, moins de bétail et dans certains endroits, un abandon total. Ceci mène souvent à une détérioration des paysages et des habitats essentiels à la survie de certaines espèces des milieux agricoles et a des implications sur la qualité des sols et de l'eau. Un soutien pour préserver ces systèmes agricoles bénéfiques à l'environnement devra être un élément fondamental de la politique si l'on veut traiter la question du sous approvisionnement en biens publics de manière satisfaisante.

Il y a des preuves du sous approvisionnement en biens publics

Quand on évalue si la demande de la société en biens publics est satisfaite, des indicateurs fournissent une mesure de l'état d'un milieu environnemental donné. A ce titre, ils donnent une indication pour savoir si la fourniture de biens publics associés à l'agriculture est suffisante. L'ensemble des 36 indicateurs européens pertinents suggère une situation de sous approvisionnement. Il y a eu une détérioration de l'état environnemental au cours du temps, à l'exception d'améliorations de la qualité de l'air, d'améliorations dans certaines régions de la qualité des sols et d'une réduction des émissions de gaz à effet de serre issues de l'agriculture. Cette situation est insatisfaisante et même là où des progrès ont été faits, il y a clairement de la marge pour davantage d'améliorations.

Spécifiquement, des indicateurs individuels révèlent un déclin continu des populations d'oiseaux des milieux agricoles (bien qu'au cours de la dernière décennie, la situation se soit stabilisée au niveau de l'UE), le mauvais statut de conservation d'une majorité de sites Natura 2000, des niveaux élevés d'érosion des sols par l'eau et le vent, une diminution de la matière organique du sol, le mauvais « état écologique » de nombreuses masses d'eaux résultant particulièrement d'une pollution diffuse, de hauts niveaux de prélèvement d'eau, particulièrement dans les zones connaissant un stress hydrique, et une perte de caractère des paysages appréciés, menacés par une perte d'éléments du paysage, une simplification et une moindre gestion.

Les preuves du sous approvisionnement sont encore renforcées par les estimations de la valeur monétaire des biens et services environnementaux et du coût de l'inaction politique. Les quelques études entreprises au niveau macro indiquent que ces valeurs monétaires pourraient être très importantes et que les pertes de bien-être associées à leur dégradation sont d'un ordre de grandeur comparable. Elles suggèrent que la société sous-estime systématiquement le degré de dégradation environnementale et que le coût d'une action entreprise pour améliorer les résultats environnementaux pourrait être considérablement moins élevé que celui de l'inaction. Ces estimations fournissent une importante motivation pour renforcer les actions et les ressources budgétaires nécessaires à l'amélioration de la fourniture de biens publics environnementaux.

Le besoin d'intervention publique à l'échelle européenne

Sur la base de ces preuves, il semble y avoir un intérêt public significatif pour obtenir sur le long terme, des niveaux durables de biens publics environnementaux fournis par l'agriculture. Une action gouvernementale est nécessaire pour y parvenir.

L'échelle d'intervention la plus appropriée dépend d'un certain nombre de facteurs. De nombreux biens publics fournis par l'agriculture, tels que la stabilité du climat ou la biodiversité, sont par nature transfrontières, alors que d'autres, tels que la résilience aux inondations ou aux feux, peuvent être définis comme des biens publics locaux ou régionaux. Alors que ces caractéristiques exercent une certaine influence sur l'échelle de l'intervention en ligne avec les principes de subsidiarité et d'équivalence fiscale, il y a un certain nombre de raisons pour intervenir à l'échelle européenne. Beaucoup de ces biens publics ont un fort élément transfrontalier ou sont des sujets d'intérêt commun à travers l'UE. Par conséquent, obtenir leur fourniture est un sujet approprié de politique européenne. De plus, la solidarité financière pour supporter les coûts de la fourniture de biens publics adhère aux principes de cohésion sociale et économique.

Fixer des objectifs spécifiques à travers le processus politique

Les décisions politiques sur le niveau souhaitable de fourniture de biens publics devraient être faites sur la base d'une compréhension solide de la demande de la société. Ces dernières années, le nombre d'objectifs spécifiques relatifs à l'obtention de résultats environnementaux a proliféré et le niveau d'ambition a augmenté. Les objectifs spécifiques fixés notamment en matière d'émissions de gaz à effet de serre, de qualité des sols, de qualité et de disponibilité de l'eau et de résilience aux inondations, ont été progressivement ajoutés aux côtés d'objectifs spécifiques antérieurs relatifs aux espèces et aux habitats.

Le rôle de la PAC dans la fourniture de biens publics

La PAC, avec un budget annuel de 53 milliards d'euros, exerce une influence importante sur la gestion agricole des terres dans l'UE et détient donc un potentiel considérable d'influence sur l'échelle de fourniture des biens publics. En plus de la PAC, un financement dédié existe aussi pour une gamme de biens publics mais à une plus petite échelle et est administré à travers le programme LIFE +, les Fonds Structurels ainsi que des mesures nationales spécifiques dans tous les Etats Membres.

Au sein de la PAC, certaines mesures – et plus particulièrement la mesure agro-environnementale dans l'Axe 2 de la politique de Développement Rural – ont des objectifs généraux environnementaux explicites. D'autres mesures de l'Axe 2 peuvent soutenir des types de gestion dans les exploitations agricoles qui sont favorables à l'environnement, tels que ceux concernés par les ZD (Zones Défavorisées) et les sites Natura 2000. Beaucoup de ces mesures se sont révélées cibler une large gamme de biens publics, avec des impacts positifs.

Il y a d'autres mesures de la PAC, telles que les paiements directs découplés sous le Premier Pilier de la PAC qui contribuent substantiellement aux revenus des exploitations agricoles. Un grand nombre des exploitations qui reçoivent ces paiements délivrent des biens publics et certaines d'entre elles peuvent dépendre de ces paiements pour maintenir leur viabilité économique, leur permettant par là même de continuer à fournir des biens publics. En revanche, d'autres exploitations qui perçoivent ces paiements peuvent ne pas fournir de biens publics ou même causer des dégâts environnementaux. Par conséquent, lier les paiements directs aux normes de Bonnes Conditions Agricoles et Environnementales (BCAE) contribue à fournir un niveau de base de biens publics. De plus, les mesures appliquées sous l'Article 68 du Règlement du Conseil 73/2009 peuvent soutenir soit des types spécifiques d'agriculture importants pour la protection environnementale soit certaines activités agricoles avec des bénéfices environnementaux.

L'analyse suggère que l'approche essentielle qui consiste à chercher à obtenir des résultats environnementaux supérieurs au niveau de référence réglementaire, en combinant la conditionnalité et des mesures fondées sur une incitation financière, est appropriée. La combinaison de mesures ciblées appliquées dans le cadre de la politique de Développement Rural et de paiements directs en association avec la conditionnalité a incité les agriculteurs à porter une attention beaucoup plus marquée aux questions environnementales, a influencé toute une gamme de décisions économiques et de gestion à travers l'Europe, a aidé à éviter l'abandon sur une échelle significative, a étendu la mise en place d'un certain nombre de pratiques bénéfiques et a contribué au maintien d'exploitations plus extensives et d'agriculture biologique, sur une vaste zone.

Alors qu'il y a des preuves de sous approvisionnement de la plupart des biens publics environnementaux clés fournis par l'agriculture, l'effort de la politique actuelle a été efficace, à plusieurs titres, pour enrayer un déclin. Face aux pressions pour concentrer et spécialiser la production, pour augmenter les économies d'échelle et maintenir la compétitivité, les pratiques de gestion bénéfiques à l'environnement ont eu tendance à être remplacées par celles qui visent des gains d'efficacité, en partie au détriment de l'environnement. En opérant dans le contexte de ces forces économiques plus larges, les mesures de la politique, telles que la mesure agro-environnementale, ont réussi, dans de nombreux cas, à enrayer le déclin des pratiques de gestion bénéfiques qui, à défaut, aurait pu se produire.

Ceci étant dit, il y a un certain nombre de raisons pour lesquelles le cadre politique actuel n'est pas parvenu à améliorer la fourniture des biens publics dans la mesure requise. Elles sont liées au poids relatif accordé aux différents objectifs généraux de la politique, au choix d'instruments de politique, à la conception et à la mise en œuvre ultérieure des mesures de politique, à l'étendue de la gouvernance et à la capacité institutionnelle et à l'adéquation des ressources budgétaires. En effet, les niveaux actuels de dépense pour les mesures de Développement Rural avec objectifs généraux environnementaux apparaissent insuffisants par rapport à l'échelle de la demande de la société et aux estimations du niveau de financement requis pour atteindre les objectifs spécifiques de l'UE pour des biens publics particuliers.

S'appuyer sur les expériences d'approches alternatives

Il y a un besoin toujours croissant d'améliorer la rentabilité des mesures de politique ainsi que d'améliorer les résultats environnementaux fournis pour obtenir des gains supérieurs au niveau du rapport coûts – bénéfices. Il existe une gamme d'approches qui sont soit actuellement utilisées soit pilotées dans l'UE et ailleurs pour encourager la fourniture de biens publics environnementaux à travers l'agriculture. Celles-ci incluent une exploration des façons d'améliorer la rentabilité ou d'augmenter les résultats environnementaux à travers l'utilisation de programmes discrétionnaires plus compétitifs, des programmes pilotes où les paiements sont faits sur la base des résultats environnementaux et l'utilisation d'approches d'approvisionnement plus collaboratives au sein d'un territoire circonscrit. Pour le moment, elles sont principalement des initiatives pilotes à petite échelle et leur applicabilité plus large en dehors des contextes spécifiques dans lesquels elles sont actuellement mises en œuvre est difficile à évaluer.

Il sera souhaitable de s'appuyer sur l'expérience acquise dans l'UE et d'autres pays pour garantir que la réponse politique s'améliore avec le temps. Cependant, aucune des approches examinées ne semble offrir d'alternative aux mesures agro-environnementales comme principal outil pour fournir des biens publics à travers l'agriculture et l'approche de programmation, qui caractérise la politique de Développement Rural à l'heure actuelle, présente des forces claires en tant que cadre politique.

Identifier les futurs besoins en matière de politique

En considérant les perspectives de l'agriculture dans l'UE au cours de la prochaine décennie ou plus, des changements dans l'utilisation et la gestion des terres vont modifier le modèle de fourniture des biens publics. Les forces de restructuration de l'agriculture laissent à penser qu'il y aura une baisse des pratiques nécessaires à la fourniture de ces biens mais il y a aussi des exemples de tendances dans la direction opposée, comme l'augmentation de l'efficacité énergétique des opérations agricoles. Ceci dit, il semble probable que la fourniture de biens publics environnementaux produits incidemment par les agriculteurs va diminuer et que des demandes supplémentaires d'interventions de politique seront faites pour traiter la question du sous approvisionnement.

Une intervention politique sera requise pour une large proportion des terres agricoles, y compris les régions de cultures plus intensives, pour garantir le maintien des fonctions du sol, la préservation et l'amélioration de la qualité de l'eau, les réductions des émissions de gaz à effet de serre, une meilleure séquestration du carbone et une meilleure résilience aux inondations ainsi que pour contribuer aux objectifs en termes de paysage et de biodiversité. En parallèle à ces interventions à l'échelle du paysage, des mesures spécifiques qui sont plus précisément ciblées sur les zones où la fourniture de biens publics est particulièrement concentrée, notamment dans les zones de pâturages extensifs, seront également cruciales.

Six défis pour une future politique agricole de l'UE

La fourniture des biens publics en Europe serait une justification valable et cohérente pour une future PAC. Le défi d'encourager cette fourniture au niveau requis pour répondre à la demande de la société est considérable mais la politique présente plusieurs atouts pour y répondre. L'intégration dans la PAC des principes de Göteborg sur le développement durable au cours de réformes successives, procure un champ suffisant pour une large gamme d'actions de politique ayant un impact sur l'agriculture et la gestion environnementale des terres. De plus, la PAC fournit un cadre européen cohérent, tenant compte d'objectifs communs, du marché commun pour l'agriculture et du besoin de maintenir une situation globalement équitable pour les agriculteurs. Elle a la flexibilité de tenir compte des différentes conditions régionales et nationales sans perdre en transparence si les politiques sont bien conçues et administrées.

Confrontée au défi de la question du sous approvisionnement en biens publics, la PAC aurait besoin de conserver une gamme d'instruments capables d'aborder la variété des conditions agricoles en Europe et l'ensemble des biens publics environnementaux. Six défis clés peuvent être identifiés si l'on imagine une révision de la PAC dans laquelle l'attention sur la fourniture de biens publics environnementaux est renforcée. Ces six défis sont:

- Accorder plus d'importance à l'intégration d'objectifs généraux environnementaux au cœur de la politique : Un cadre politique cohérent est nécessaire pour gérer les tensions entre les objectifs généraux de la politique et pour garantir qu'un équilibre approprié est trouvé entre les dimensions économique, sociale et environnementale d'une agriculture durable.

- Etablir des objectifs spécifiques appropriés : Avec une attention particulière sur les biens publics environnementaux, il sera important d'établir des objectifs spécifiques clairs pour toute la gamme de biens publics que les mesures pertinentes de politique sont censées procurer.

- Accroître l'efficacité et la performance des mesures : Sélectionner les mesures de politique requises pour atteindre ces objectifs spécifiques à un niveau européen nécessite de prêter l'attention qu'il mérite au besoin pour les mesures d'être à la fois efficaces et performantes.

- Améliorer la mise en œuvre : L'utilisation d'une gamme de mesures de politique en synergie peut aider à atteindre de meilleurs résultats. Ceci nécessite une approche coordonnée de la conception de programmes et de favoriser une plus grande capacité institutionnelle au niveau des Etats Membres, y compris la fourniture aux agriculteurs de conseil et d'un renforcement des capacités.

- Suivi efficace et évaluation : Le suivi et l'évaluation des impacts des dépenses dans le cadre de la PAC est fondamental pour garantir la responsabilisation et pour permettre de faire des améliorations en termes de conception et ciblage du soutien. Le Cadre Commun de Suivi et d'Evaluation (CCSE) pour la Politique de Développement Rural fournit une fondation solide en la matière.

- Obtenir des ressources budgétaires suffisantes : Les calculs concernant les besoins en financement démontrent la différence significative entre le niveau de financement qu'on estime nécessaire pour atteindre les objectifs spécifiques environnementaux européens et celui actuellement disponible pour les mesures de la PAC centrées sur la fourniture de biens publics. Obtenir des ressources budgétaires suffisantes pour soutenir la fourniture de biens publics semblerait être une priorité claire pour le futur.

Demandes contradictoires pour l'utilisation des sols dans l'UE

En plus de satisfaire aux besoins de la société en biens publics environnementaux, il y a des demandes contradictoires concernant l'utilisation des sols en Europe, qui seront vraisemblablement exacerbées dans le futur. On peut s'attendre à ce que des changements potentiellement substantiels surviennent dans la gestion des terres du fait de différentes pressions, avec comme impact probable de certaines de ces tendances, une intensification croissante et une augmentation de la surface destinée à la production arable. Beaucoup seront en conflit direct avec la fourniture de biens publics et contribueront donc à un risque accru de sous approvisionnement dans les cas où l'intervention politique est insuffisante.

Les terres étant une ressource limitée, la fourniture de biens publics associée à l'utilisation du sol devrait refléter l'optimum social en Europe, aussi bien à l'heure actuelle qu'en prenant également en compte les besoins et exigences des générations futures. Ce qui est considéré être dans le meilleur intérêt de la société reflètera des objectifs généraux communs pour l'alimentation, l'environnement, la bioénergie et la cohésion sociale et économique, mais il est essentiel que l'ensemble des priorités de l'Europe soit évalué d'une façon stratégique et intégrée, en portant une parfaite attention aux arbitrages que peut impliquer l'atteinte de ces objectifs généraux. Enfin, l'ensemble des besoins plus larges de l'Europe provenant de l'agriculture n'est pas satisfait par les exploitants des terres au sein de l'UE, qui dépend beaucoup d'importations alimentaires et d'autres biomatériaux. Ceci souligne le besoin de considérer le modèle global de l'utilisation du sol et de l'activité agricole lorsqu'on pense au rôle de l'agriculture dans la fourniture à la société d'un flux continu de biens tant publics que privés.

1 PUBLIC GOODS – A CONCEPTUAL FRAMEWORK

1.1 Introduction

In Europe, agriculture has received a sustained level of public support over the last 50 years. Other productive sectors of the economy are not subject to public intervention on this scale which raises the question as to why it continues to be required given that the EU's agriculture sector is increasingly competitive and market oriented following recent reforms of the CAP. It is widely argued that the provision of public goods provides a valid reason for public intervention in a market economy. This chapter presents the theoretical arguments underpinning the case for support for the provision of public goods in the agricultural sector and discusses the related policy implications.

In certain respects, agriculture is like other economic sectors, with a large number of producers participating in a range of markets, such as those for food, fibre, and raw materials for energy and industrial products. In other respects, it has certain characteristics, which means that the potential for the provision of public goods in the field of the environment is widespread in this sector:

- There is a high level of interaction with the environment in the course of production and as such, certain types of agricultural land management shape cultural landscapes, improve the quality of water and soils, and underpin the maintenance of semi-natural habitats and the survival of wild species.

- Agricultural production is spatially diffuse and occupies a large share of the European land area, leading to an appreciation on the part of the wider public of the close association between farming and the European countryside.

In the scientific literature, Samuelson (1954; 1955) and others (Peston, 1972; Cornes and Sandler, 1996) have argued that a shortfall in the provision of public goods, such as clean water, biodiversity and a stable climate, compared to the scale of public demand, underpins the case for public intervention. The reason for this under-provision is because public goods are not supplied satisfactorily through the market and without a functioning allocation mechanism[1], the provision of public goods will remain below the level desired by society. This rationale for public intervention underpins a number of sectors or realms of public policy, such as the provision of basic health services, and law and order.

1.2 The Public Goods Concept

The public goods concept is well established in economic theory although there is a wide range of interpretations as regards their characteristics and the corresponding implications for policy (Baumol and Oates, 1998; Tietenberg and Lewis, 2009). As first conceptualised by Samuelson, public goods exhibit two defining characteristics, and are:

- Non-excludable – if the good is available to one person, others cannot be excluded from the benefits it confers.
- Non-rival – if the good is consumed by one person it does not reduce the amount available to others.

A commonly cited example of a public good is that of farmland biodiversity, exemplified by the Great bustard (*Otis tarda*), a rare grassland bird species found in southern and central Europe. People cannot be excluded from enjoying these birds (non-excludable), and one person's enjoyment does not reduce the enjoyment of others (non-rival). At the other end of the spectrum are private goods – such as a crop of wheat – the consumption of which is both rival and excludable.

Public goods provided through European agriculture can take the form of physical entities – such as cultural landscapes or a specific habitat – or the form of services – such as resilience to flooding or fire. These stem from the interaction of farming practices, both past and present, with the natural world, biophysical conditions, and socio-cultural processes. In many regions of Europe, a range of second order economic and social effects depend on the existence of these public goods. The ecological integrity and attractiveness of rural areas are important contributors to feelings of social well-being and cultural identity, as

[1] An allocation mechanism is defined as the apportionment of productive assets among different uses. The issue of resource allocation arises as societies seek to balance limited resources (capital, labour, land) against the various and often unlimited desires of their members. Mechanisms of resource allocation include the price system in free market economies and government planning, either in state-run economies or in the public sectors of mixed economies. The aim is always to allocate resources in such a way as to obtain the maximum possible output from a given combination of resources (Encyclopædia Britannica 2008).

well as underpinning economic activities such as tourism, recreation, and the marketing of locally distinctive products (as discussed in Chapter 6).

Although public goods are often discussed in terms of desired outcomes, a good in a strict economic sense refers to a physical entity or service that is subject to an economic transaction. This specification is useful, as it distinguishes public goods from those by-products of certain agricultural activities which are beneficial, and which may well have public goods characteristics, but which do not require any financial support to ensure their delivery.

However, for those cases where an allocation of resources is required to support the provision of the public good, the farmer needs an incentive to do so, and thus an economic transaction is required. For example, the availability of suitable habitats for the Great bustard depends on appropriate land management practices that may not be the most profitable in a given area. Without remuneration for the continuation of those practices that support the maintenance of these grassland and arable habitats, farmers may revert to a more profitable form of land use, resulting in the loss of habitat, and a decline in species numbers.

The non-excludable and non-rival characteristics of public goods are influenced by their biophysical character. These characteristics of non-excludability and non-rivalry are not either 'present' or 'not present'. In reality, both may be exhibited to almost any degree, from zero to 100 per cent. In many cases, non-excludability can be influenced through the establishment of technical exclusion mechanisms, the potential for which is often limited due to the costs associated with the act of exclusion. As regards non-rivalry, this characteristic of public goods can fall victim to congestion effects, implying that at a certain intensity of use, the enjoyment or benefit perceived by the single user is depleted. This means that all public goods will be situated along a continuum of 'publicness' as represented in Table 1.1 below.

Table 1.1 Classification of goods according to their degree of publicness

Degree of Publicness			
Low	**Medium**		**High**
Private Good	**Club Goods**	**Impure Public Good**	**Pure Public Good**
Rival	Non-rival for a small user group	Non-rival	Non-rival
Excludable	Excludable	Excludable only at high costs	Non-excludable
Excludable and rival.	Excludable, but subject to congestion as the number of users increase.	Exclusion - even if technically feasible - is costly, therefore there is a high risk of congestion.	Exclusion technically impossible. Very high degree of non-rivalry in consumption, with a certain degree of congestion possible.
Examples: • Wheat • Timber	Examples: • Private parks • Golf course	Examples: • Public access to farmland • Landscapes and landscape features	Examples: • Stable climate • Air of high quality • Biodiversity • Non-use values of landscape

The degree of publicness determines the maximum number of people who are able to consume the public good. A public good which displays a high degree of publicness, such as clean air, is largely non-rival and no-one can be excluded from consuming it. This means that the number of people who can enjoy it is extremely large. However, in practice, even a public good with a global degree of publicness such as clean air may be subject to overuse, as demonstrated by the accumulation of greenhouse gases in the atmosphere, for example.

Certain public goods exhibiting a medium degree of publicness are non-rival but there is a risk of congestion as the number of users increase. In this case, the condition of the good, and people's enjoyment of it may be depleted. Certain goods with a lower degree of publicness, such as club goods – including golf courses or private parks – are non-rival for a limited number of users, but entrance to the club may be restricted to paying members with non-payers excluded from entry. On account of these barriers, the number of people deriving enjoyment from them is limited. If too many people are allowed to enter, the facility becomes congested, and thus rival in consumption.

1.3 Coordinating Supply and Demand through Appropriate Allocation Mechanisms

Under the conditions of a free market, private goods are supplied through market interactions, with supply and demand coordinated via a decentralised pricing mechanism. If there is a decline in supply or an increase in demand, the price tends to rise, and if demand declines or supply increases, prices tend to drop. The efficient functioning of this allocation mechanism is predicated on the ability of consumers to articulate demand for a given private good through their purchasing power, to verify their satisfaction after its consumption, and for suppliers to organise their factors of production in a way that allows them to respond to demand and to levy a charge for their product. This means that markets are efficient where there are defined property rights, low transaction costs and complete information.

Market mechanisms, however, do not function for the provision of goods with a high degree of publicness. A market cannot function as an allocation mechanism between suppliers and consumers in cases where consumers cannot be excluded from consuming the good and therefore have no incentive to pay for it. These circumstances are likely to lead to 'free-rider' behaviour and to the over-exploitation of the respective public good. The absence of an articulated demand means that the public good has no price. As a result of the defining characteristics of public goods, and the fact that they cannot be secured through ordinary market mechanisms, farmers have few incentives to provide them because they are not being paid to do so - leading to a situation of undersupply. In order to prevent the decline of public goods into the future, other allocation mechanisms are needed to steer resource use towards the provision of a given public good.

A phenomenon that is often associated with public goods is the over exploitation of commonly owned land, known as the "tragedy of the commons" (Hardin, 1968; Ostrom *et al*., 2002). Indeed, over exploitation results from non-exclusion from use – one of the main characteristics of public goods. However, common land displays characteristics completely different from those of public goods. Principally, non-exclusion in the case of the "commons" is not determined by technical or biophysical characteristics of the land, it is the absence of sufficiently well defined and enforced property rights concerning the land. Therefore, the solution to the tragedy of the commons lies in defining precise property rights for the land in question to determine where responsibility for their appropriate management lies, and in enforcing them.

For so-called club goods, common action by a limited number of potentially interested people is sufficient to ensure the provision of those goods which demonstrate degrees of non-rivalry, but where consumption can be limited to club members (Cornes and Sandler, 1996). In these cases, the good can be offered to a potential group of users, who as club members become consumers, subject to their agreement to rules for cost-sharing and user rights. In this sense, common action leads to a functioning allocation of the resources needed to provide the club good for the benefit of club members.

For public goods characterised by a higher degree of publicness, such as climate stability, air quality and biodiversity, the coordination of supply and demand can only be achieved through more complex mechanisms of social action. A core element in this is the need for a collective articulation of demand, with respect to the scale of public good provision desired by society as a whole. When the number of potential consumers is large, this occurs through the institutionalised political process. Society's collective demands (including those of present and future generations) are often expressed in political targets which stipulate the level of provision required. The intervention of the state in securing the provision of public goods is supported by administrative mechanisms, including monitoring and evaluation and verification procedures, to ensure that suppliers act in line with agreed terms in relation to the public goods provided.

Following a political decision about the desirable level of provision, mechanisms can be introduced translating this demand into a request to those economic actors who are in a position to provide the public good(s). The mechanisms stimulating voluntary supply may take a variety of forms often, but not exclusively, modelled after market mechanisms. They include, for example, incentive payments or those with competitive elements such as auctions or tradable emission certificates (as discussed further in Chapter 7).

It is often argued that the more competitive approaches afford a possibility to create markets for the provision of public goods. However, while policy instruments can be developed to operate as substitutes for a market the result is, strictly speaking, not a fully functioning market because two essential elements are missing. First, a direct interaction of demand and supply is absent. Second, there is no means for society as consumers of public goods to verify their satisfaction of the goods provided - a quality check that is done by the individual consumer in an open market. In the case of public goods, the use of market mechanisms therefore is often limited to stimulating competition among suppliers to improve the cost effectiveness of delivery.

The discussion above demonstrates that the allocation mechanism which best ensures a reallocation of resources towards the delivery of public goods is influenced by the good's 'degree of publicness'. It also points to the number of people who have to interact to stimulate the supply of both private and public goods, ranging from individual actors (individuals, households or firms) operating in a market, to the common action of club members, to governments negotiating with multiple economic actors on behalf of society at large.

1.4 Identifying the Case for Public Intervention

The line of argument developed above establishes the relationship between a good's degree of publicness, along with its physical characteristics, and the allocation mechanism necessary to coordinate supply and demand. There is, however, no *prima facie* case for public intervention to secure the provision of all of the public goods associated with agriculture for the reasons discussed below. Public intervention is only needed in those cases where the current level of provision falls short of that demanded by society. In other words, and as elaborated in Chapter 4, the case for public intervention can be made when in its absence, undersupply would occur.

1.4.1 Certain Public Goods are Provided Incidentally

Certain types of agricultural activity in the EU provide a range of benefits which are highly valued by society. Given the limited availability of public finances and competing priorities, it is not necessary to intervene to secure the provision of public goods if these are provided incidentally[2], as a side-effect of economically viable activities, and to the full satisfaction of the public. Many of the public goods associated with agriculture have been provided either incidentally, or as a result of philanthropic behaviour or self-interest on the part of certain farmers. Their continuing or future provision is not always guaranteed, however. For example, market forces and technological innovation have propelled traditional extensive agricultural systems down a route of restructuring towards more profitable forms of land use, or sometimes towards complete abandonment. In these cases, the opportunity costs associated with the continuation of those forms of land management which provide public goods increase, leading - in the absence of public support - to a contraction in the flow of public goods, with the potential for increased scarcity in the future.

In this sense, the undersupply of a public good triggers the requirement for action and underlies the need for an allocation mechanism that allows economic transactions to take place to ensure adequate supply. Typically this will involve economic incentives for land managers to ensure the allocation of their factors of production towards the desired provision of a respective public good.

The unintended and indirect side-effects of certain operations in agriculture and elsewhere are also referred to in economic theory as 'externalities'. Indeed, inappropriate agricultural management practices can have detrimental effects on environmental media, such as pollution of groundwater, surface waters, erosion of soil or degradation of habitats, as an unintended consequence of

[2] The incidental provision of public goods occurs when the socially required quantity of the public good is provided alongside the agricultural commodity, and where a deliberate allocation of resources is not required to ensure its ongoing provision. In these cases, the provision of the public good is not dependent on public support.

‘normal’ agricultural production, although this is common to most productive activities competing for the use of scarce resources. The idea behind the theoretical conception of externalities is to signal the need for these effects to be internalised, which means that they are accounted for by individual actors and become the subject of a deliberate allocation decision (OECD, 1989). Internalisation is typically achieved through defining clear user rights.

The internalisation of external effects becomes necessary if the unregulated situation is considered unsatisfactory and the ‘internalisation’ of the external effect carries the potential for welfare gains. On this basis, policy measures can be established that incentivise interested parties to take a deliberate decision about the use of resources, in response to society’s demands for the public good in question. Once the coordination of the supply and demand of a public good has become a matter of a well-established allocation mechanism, a former externality ceases to be regarded as “external” in nature – it has become “internal” to the economic process.

In summary, certain public goods may be provided incidentally as a side-effect of economically viable activities, or as a result of farmer self-interest or altruism. As soon as their provision is under threat, it is the role of the State or an appropriate form of government to steer the allocation of the factors of production to stimulate supply in line with societal demand. These arguments establish the broad case for public intervention and in the following section we discuss the most appropriate scale at which intervention should occur.

1.4.2 The Scale of Intervention

Certain characteristics of public goods, such as their site-specificity or transboundary nature, influence the most appropriate geographic or administrative scale of public intervention (Scheele, 2000). In this regard, a distinction is made between ‘local’ and ‘global’ public goods. When the public good is only available within a given local area and shows site specific characteristics, such as a buffer zone around a lake or a recreation area for local benefit, it may be regarded as a ‘local’ public good. Decisions about the scale of its provision and the most appropriate form of management should ideally be taken at the local level in line with the ‘principles of subsidiarity and fiscal equivalence’, whereby the responsibility for intervention and expenditure lies with the administration closest to the beneficiaries of the public good in question.

‘Global’ public goods fall at the other end of the spectrum, and include global biodiversity and a stable climate, both of which exhibit transboundary characteristics. In these cases, mitigating climate change or delivering biodiversity objectives cannot be achieved through action at the local level alone. Measures for mitigating climate change can be applied at the regional or even local level, but these will have no noticeable impact if the efforts are not supported by activities at the global scale resulting from international political intervention.

In practice, however, what constitutes the most appropriate scale of intervention does not reflect these neat divisions between 'local' and 'global' public goods, because they do not take broader 'non-use values' into account. These values often mean that citizens care about the ongoing existence of certain public goods - such as the protection of endangered species or the preservation of certain habitats - and are willing to bear the costs, even though they are not immediate users and may be far removed from the public goods concerned. 'Non-use values' also demonstrate the characteristics of non-rivalry and non-excludability, and therefore add a high degree of publicness to certain public goods which, on the basis of their physical characteristics alone, would otherwise be classified as 'local' public goods.

In reality, 'non-use values' are important drivers of policy decisions and as such, political intervention at a higher administrative level is necessary to ensure that the demands made by non-users are represented. Political and financial intervention at an international level is also needed where certain countries or regions have insufficient funds to address local needs, or in contributing to the achievement of common supranational objectives, countries or regions face a disproportionate burden in meeting the costs of providing the public goods in question. This is in line with the objectives of economic and social cohesion.

Having both clarified the case for public intervention and discussed those factors that influence the scale at which intervention should occur, the question of who bears the costs associated with the provision of public goods is addressed in the following section.

1.5 Providing Public Goods versus Avoiding Environmental Harm

In the preceding sections, it has been argued that where there is an undersupply in public goods relative to societal demand, some form of public intervention is needed and political decisions are required to determine an appropriate scale of provision. This means first, agreeing on acceptable targets and second, encouraging providers to deliver public goods in line with these targets. In practice, this means farmers allocating resources to deliver an outcome that is different from what is likely to happen if only market signals are followed – for example, the retention and management of landscape features rather than removing them to increase field sizes in order to reduce private unit costs. As there will be costs associated with changing the allocation of resources towards the provision of public goods there is third, a consideration of who bears the costs – the farmer or the tax-payer? Economic theory provides an orthodox answer to this question by referring to the setting of property rights.

In present day discussions about the distribution of costs for achieving environmental objectives, reference is made to the 'Polluter Pays Principle' (PPP), a basic principle of cost allocation. Established in the early 1970s, and adopted by the OECD in 1974, the PPP states that 'the polluter should bear the cost of measures to reduce pollution according to the extent of either the damage done to society or the exceeding of an acceptable level of pollution' (OECD, 1974).

In an agricultural context, the Polluter Pays Principle stipulates that farmers bear the costs of avoiding or repairing any environmental harm resulting as a side-effect of their agricultural activities. This principle can be translated into concrete policy terms by setting mandatory standards, enforced by means of some penalty on those who fail to comply or to achieve the required standard (OECD, 1989). The Polluter Pays Principle conveys one strict message - payments should not be made for any action arising from the need to comply with mandatory requirements and other environmental standards – and that the costs of achieving certain environmental outcomes fall onto farmers.

In its initial formulation, the Polluter Pays Principle focused on finding a means for allocating costs in relation to avoiding environmental harm. It does not take account of the fact that it is often privately owned factors of production, such as land and capital, which are needed to provide desirable environmental outcomes. As environmental outcomes - such as the maintenance of semi-natural habitats, for example - require engaging privately owned land and capital, as well as labour, it became clear that those environmental results are achievable only if the providers are offered a financial incentive to do so.

To make a distinction between those cases where the costs of reaching certain environmental outcomes fall onto the operators, and those where private actors are remunerated for providing environmental public goods, the OECD developed the concept of the 'reference level' (OECD, 1998; Scheele, 1999). In effect, the reference level defines the dividing line between the level of environmental responsibility farmers are expected to assume at their own expense, and those actions that lead to enhanced environmental delivery which farmers may be willing to undertake for adequate remuneration.

The concept of the reference level also introduces an institutional dimension into the equation, by taking into account existing property rights or - where these do not yet exist or are not clearly specified - by defining and allocating the property rights to the resources needed for responding to the public interest. Property rights stipulate what someone may or may not do with respect to a certain physical entity, thereby determining who receives an income from employing the factors of production (land and capital) for the provision of certain goods and services (Bromley and Hodge, 1990).

As explained above, establishing property rights is the very precondition for integrating resources or assets into allocation mechanisms that function to steer resource use towards the provision of public goods. However, there are no guiding rules for where property rights are set, nor is there a *prima facie* reason for granting or denying property rights to one particular group of operators/farmers or to another, notwithstanding the fact that the allocation of property rights does have economic implications for the individual farmer.

To illustrate this, a farmer – as the owner of a plot of land that provides a habitat for rare species – may have the right to plough it for conversion to a more profitable land use, and therefore to destroy the habitat, or he may have a duty to maintain the habitat in line with society's biodiversity interests. In the first case, he may have the right to plough, however, he may be willing to allocate his factors of production towards the preservation of the habitat if he is offered a payment to do so which is sufficient to cover his income forgone. In the second case, the destruction of a habitat is not part of the property right of the land manager and therefore, the farmer would bear the opportunity costs of denied conversion.

These considerations are reflected in the 'Coase Theorem' which underlines that the optimal allocation of resources follows from the highest achievable benefit, independently of the initial allocation of property rights (Coase, 1960). The question of to *whom* to grant the property rights, or *where* to set the reference level, depends neither on the desired overall outcome nor can it be derived from any biophysical characteristic of the issue at stake. The setting of the reference level is solely a question of legal tradition, political history and considerations of equity and fairness. What matters economically is that establishing those rights is the crucial step required to allow environmental outcomes to be internalised within an economic transaction. On this basis, functioning allocation mechanisms can steer resource use towards achieving enhanced levels of environmental delivery in a cost effective way.

These considerations explain why reference levels may be set at different levels in different societies. In an agricultural context, the reference level is either enshrined in legislation setting out legal requirements in relation to minimum standards which must be adhered to by law, or captured within standards of good agricultural practice, which are not enforceable in the legal sense, but are practices that are expected of all farmers. Reference levels can change over time in response to alterations in perceptions about the rights of landowners and farmers, or changes in what is considered as fair. The consequences can be shifts in the reference level to reflect these. Nonetheless, in the EU, there are certain generally agreed rules about the responsibilities of private ownership which allow an appropriate reference level to be determined in a consistent manner across a whole range of different contexts (Hodge, 2008).

1.6 Matching Supply and Demand through Economic Incentives

As argued earlier, to encourage those actions that deliver environmental quality beyond mandatory requirements to meet political targets and to satisfy society's demand for enhanced environmental delivery, an economic incentive is required. When a farmer holds claims to the property rights and to the factors of production - and therefore can expect a factor income from them - society or the taxpayer has to purchase what amounts to a reallocation of resources necessary for the provision of public goods. This requires a payment set at an appropriate level.

There are a range of mechanisms for stimulating voluntary supply, including those with competitive elements such as auctions or tradable emission certificates, alongside less competitive approaches, such as the provision of incentive payments. The more competitive mechanisms may provide public goods at what is apparently a lower cost, however, the gains achieved may be outweighed by additional costs which stem from the necessary administrative arrangements.

Incentive payments are a commonly used tool to encourage farmers to provide public goods, in order to render the necessary activities as profitable as those under a pure agricultural production logic. The payment to the land manager or owner should be based on the income foregone or cost incurred to cover the opportunity costs of altering the land managers' allocation of factors of production. Some level of additional remuneration may be required to cover the farmer's transaction costs or similar barriers to a reallocation of resources. The payments are likely to differ between different farmers and between regions. The public administration, representing society's interest in securing the provision of public goods at least cost to the public purse, is charged with the design and implementation of a cost efficient policy.

Figure 1.1 illustrates this discussion by showing, diagrammatically, the relationship between the reference level, environmental targets and different policy instruments, in relation to delivering increasing levels of environmental quality.

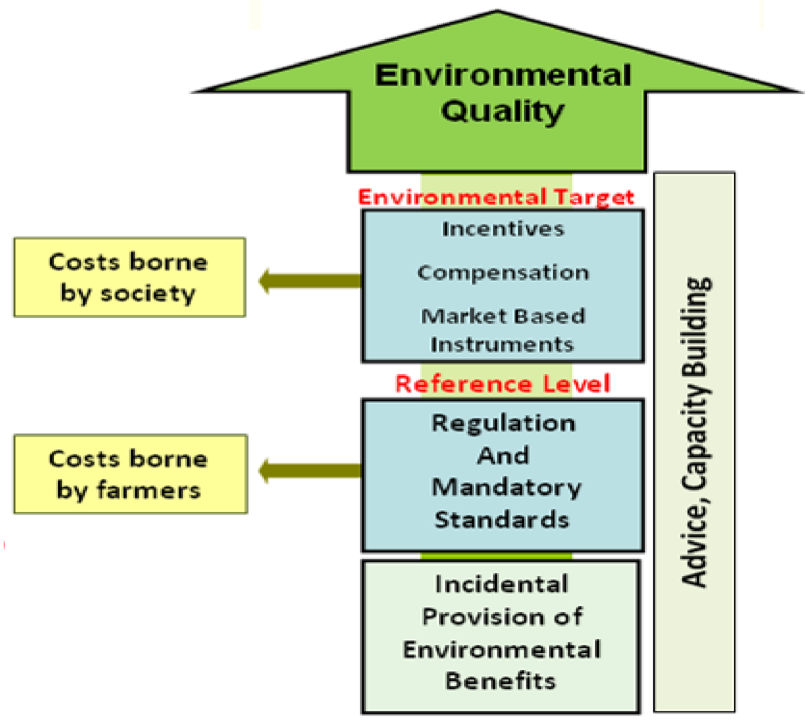


Figure 1.1 Environmental targets and the reference level

Source: Adapted from OECD, 2001b, and based on Scheele, 1999.

1.7 Conclusions

The theoretical framework developed here affords insights into the characteristics of public goods, along with the most appropriate allocation mechanism needed to secure their supply in line with society's demand. It concludes with an examination of the case for supporting the provision of public goods through some form of public expenditure programme. However, any policy conclusions drawn from these theoretical considerations must reflect the wide variety of natural, economic, structural and institutional conditions encountered in the countries and regions of Europe.

One key aim of this study is to identify where public goods arise from agricultural production and where public support measures are needed to ensure their provision in different regions and under differing circumstances. The eight chapters that follow discuss these empirical and policy challenges in-depth.

2 THE MAIN PUBLIC GOODS PROVIDED THROUGH AGRICULTURE IN EUROPE

2.1 Introduction

Agriculture has been practiced in Europe for millennia such that there is little remaining wilderness. It dominates as a land use, at the present time accounting for approximately a half of the territory of the EU-27 Member States (EEA, 2006a). As a productive activity – the primary purpose of which is the production of food and other materials – it transforms the pre-existing natural environment, by impacting on resources, on the functioning of natural systems and by restricting the species present. Consequently, its environmental impact – both positive and negative – is considerable.

Some of these changes to the natural environment occurred over millennia, whereas others are more recent. The technologies of the last two centuries, and especially those developed in the last half century in response to higher levels of demand, have increased agriculture's capacity to impact on the environment. Indeed, food production in Europe has accelerated over the last century, stimulated by policy drivers and market forces, and leading to technological advances driven by the search for efficiency gains and increasing intensification, such that Europe is a major global producer of food.

These productivity gains have not been without environmental and social costs. Like any productive activity in competition for scarce resources, agriculture has had an adverse environmental effect partly because it involves the use of resources which are *de facto* non-renewable, or at least only renewable over long periods of time. There is widespread evidence of these adverse environmental impacts, resulting in the loss of habitats and declines in species numbers, the pollution of groundwater and surface waters, and extensive soil degradation.

That said, certain forms of agricultural production have provided a wide range of both social and environmental benefits to society in the form of public goods. Low intensity farming systems, in particular, provide a suite of public goods, by maintaining and enhancing biodiversity and landscape, and typically by having a range of associated practices that promote good soil and water management. In addition, and common across all farming systems, specific land management practices can be adopted which deliver public goods to society, such as enhanced carbon storage capacity, increased resilience to flooding and those which improve the quality of our soil, air and water resources.

In addition to these environmental public goods, agriculture in many regions of Europe has played an important role in shaping the cultural heritage and sustaining social capital in rural areas. A wide range of economic activities such as rural tourism and recreation also depend on the existence of public goods provided by agriculture such as cultural landscapes and farmland biodiversity. In Chapter 3, those types of agricultural activity which provide both a wide range of public goods and improve the condition of specific environmental public goods are examined in more detail, exploring the key factors that give rise to these beneficial outcomes.

2.2 Public Goods Associated with Agriculture in the EU

In the section that follows, the most significant public goods associated with agriculture in the EU are discussed. These include environmental public goods, such as agricultural landscapes, farmland biodiversity, water quality and water availability, soil functionality, climate stability – carbon storage and climate stability – greenhouse gas emissions, air quality, resilience to flooding and resilience to fire, and more social public goods, including rural vitality, food security and farm animal welfare and animal health.

Many of these public goods are complex entities, comprising a range of different elements, with both public and private characteristics. Food security provides an example of a public good with distinct private characteristics as certain of the elements that create the conditions for food security, including the factors of production (such as land and the soil resource), are privately owned. Markets exist to coordinate the supply and demand of these elements, although not necessarily in all places and at all times. As such, the case for public intervention in relation to food production *per se* is small.

In Chapter 1, it is argued that the defining characteristics of public goods – non-rivalry and non-excludability – means that their provision cannot be secured through markets, often leading to an undersupply in the absence of public intervention. These arguments are revisited in subsequent chapters however, where the provision of public goods is not under threat at the present time or in the immediate future, public intervention is not required.

The most significant public goods associated with agriculture in the EU do not all share the same underlying relationship with agricultural production. For certain public goods – such as particular species and habitats, agricultural landscapes and resilience to wildfire – their existence is *inherently* linked to certain types of agricultural activity and there are limited opportunities for them to be provided through alternative forms of land use. This inherent relationship exists because of the co-evolution of European landscapes and the adaptation of many species to agriculture over significant periods of time, such that there is a close interrelationship between these valued environmental public goods and certain attributes of the agricultural systems with which they are associated (Havlik *et al*., 2005; Hodge, 2008).

For others - such as improving climate stability through carbon storage and reductions in greenhouse gas emissions, increased resilience to flooding, soil functionality, water quality and water availability, as well as air quality - their provision is not dependent on agricultural activity *per se*, and indeed, these public goods could be provided through alternative forms of land use. A landscape's resilience to flooding, for example, could be improved through restoring saltmarsh or wetland forest, and soil carbon stocks would increase through afforestation or the flooding of peat. The restoration of more natural habitats to support a different assemblage of species may be desirable at a micro-scale, but is less so at a larger scale as food production capacity would be compromised. This means, therefore, that because of society's requirements for food, the provision of these public goods will continue to depend on those forms of agricultural activity which are typically less environmentally intrusive in nature, and thus on those management practices which tend to reduce the adverse effects of agricultural production.

2.2.1 Agricultural Landscapes

Over several millennia, agriculture has transformed what in most parts of Europe was a wooded climax natural vegetation to open landscapes, and over time, many of these man-made agricultural landscapes have become highly appreciated in their own right. Agricultural landscapes are composite entities, a reflection of topography and the physical environment, comprising a cultural, archaeological and built heritage, as well as an ecological infrastructure underpinning many of the ecosystem services that landscapes provide, including their resilience in the face of future climate change (European Landscape Convention, 2008; Swanwick *et al*., 2007). In some places, agriculture - and the cultural features associated with it - dominates the landscape, but often it is distributed within a patchwork of other land uses, including areas of woodland or forestry, built development and patches of unmanaged land. These cultural landscapes have evolved over time as a result of a complex and often regionally-specific interaction between natural and cultural factors driven by socio-economic and environmental forces (Wascher, 2004; 2005). European agricultural landscapes are characterised by their heterogeneity and local distinctiveness with social preferences mirroring this diversity, varying significantly between localities and communities.

Agricultural landscapes as a whole display a high degree of publicness. At a composite scale, it is difficult to exclude anyone from experiencing the benefits of a particular landscape because some form of public access to agricultural land is permitted by law in the majority of Member States. Generally, rivalry in consumption is also limited, although congestion can occur in popular areas, when an individual's experience of the landscape may be compromised because of large numbers of other visitors. Certain agricultural landscapes – such as the 'lemon gardens' - "giardini di limoni" - in Italy's southern peninsula, the *dehesa* landscapes of southern Spain, or the mosaic landscapes of the traditional agro-ecosystems in the Carpathians, Slovakia – are also imbued with significant existence values, and are valued by people from many other parts of Europe even if they do not experience the landscape directly. At the more micro scale, certain landscape features, such as hedgerows in exposed areas, for example, provide a valuable private benefit and thus the public good is provided in conjunction with the private activity, for as long as that private activity remains viable.

Not all agricultural landscapes in the EU are valued as desirable public goods. Certain landscapes have been intensified and denuded of more natural features through, for example, large-scale specialisation or mono-cropping, widespread production under glass or plastic, or otherwise transformed through the introduction of exotic plantations, for example, all of which can seriously impact on a landscape's ecological, aesthetic and socio-cultural character. As such, the maintenance of landscape character and a landscape's ecological integrity typically depends on ongoing sympathetic agricultural management, a significant degree of continuity and coherence in the pattern of the main landscape elements, and the maintenance of characteristic landscape features.

Certain valued agricultural landscapes in the EU are maintained incidentally as there are high levels of technical interdependencies with the production process, although there is unlikely to be a simple relationship between the agronomic requirements and the quality of the landscape. However, where the character of the landscape is under threat of degradation, the case for public intervention is high, especially given that coordinated action is required at the landscape scale. This is particularly true for the maintenance of relic features which provide a clear environmental or cultural benefit, but no longer serve an agronomic function and may indeed be an economic impediment to the present day farm business.

2.2.2 Farmland Biodiversity

Farmland biodiversity in Europe can be considered to be a public good which has an intrinsic value. Whether conceived in terms of the species and habitats that comprise farmland biodiversity, or as the range of associated services that they provide to society, these respective components of farmland biodiversity share the characteristics of public goods (Fisher and Turner, 2008). There is a high degree of non-excludability as it is difficult to put technical restrictions in place that exclude people from the benefits associated with farmland species and habitats, although hunting is an important exception, where certain species are exploited privately, and under other circumstances, access to species can be restricted where it is necessary to protect endangered species or habitats. In addition, one person's enjoyment of biodiversity does not detract from or impact upon that of another, and so species and habitats are non-rival up to a point, although congestion effects may occur.

Farmland species and habitats exhibit a varied relationship with agricultural land management. Throughout most of Europe, centuries of agricultural management has transformed the native, climax vegetation, resulting in significant changes in vegetation composition and structure. Many species are dependent on the continuation of certain agricultural land uses and associated management practices, because certain agricultural habitats (such as grassland steppes) are analogues of former natural habitats that no longer exist in a European context. Other species, such as hedgerow birds, for example, are widely dispersed in non-agricultural habitats as they are primarily woodland species, and therefore are not so dependent on agricultural habitats *per se*.

More extensive agricultural practices often create optimal levels of disturbance and thus generate multiple ecological niches that support a wide range species (Grime, 1973; Beaufoy *et al*., 1994; Kleijn *et al*., 2008). As such, the relationship between agricultural production and the provision of farmland biodiversity is complementary, as agricultural activity enhances species richness up to a certain level of production intensity. Largely on account of this complementary relationship, a proportion of farmland biodiversity – in the past at least – has been provided incidentally alongside the core production process without the need for a deliberate allocation decision.

As practices favourable to maintaining farmland biodiversity are abandoned – driven by changes in economic conditions, technological innovation and changing socio-cultural circumstances – this complementary relationship derived from a long period of co-evolution is undermined. To maintain or restore farmland biodiversity, either these complementary practices need to be maintained or, in more intensively managed agricultural landscapes, specific practices need to be introduced to ensure adequate feeding, breeding and nesting sites for a majority of farmland species and to promote ecological connectivity (Tucker and Evans, 1997; Pain and Pienkowski, 1997). This requires a deliberate allocation of the factors of production on the part of farmers and thus the maintenance and enhancement of farmland biodiversity is increasingly dependent on public intervention.

2.2.3 Water Quality and Water Availability

Agriculture impacts on both the availability and quality of Europe's water resource. It is one of the largest consumers of water in the EU for irrigation and use by livestock, utilising a combination of natural precipitation, water abstracted from aquifers and surface sources, and that stored in tanks and reservoirs. It accounts for 24 per cent of total water abstraction in Europe, with only about a third of that abstracted returned directly to the water body (EEA, 2009a). In addition, agricultural water use is unevenly spread. In some southern European regions, agriculture accounts for more than 80 per cent of water abstraction and peak abstraction typically occurs in the summer when water is least available. The quality of watercourses traversing agricultural land is influenced by levels of contamination from eroded soil, and the leaching of inputs (fertilisers, manure, pesticides and herbicides). These impacts are generally diffuse in nature, extending along the length of a river catchment, far beyond the confines of the land of the private operator.

Thus agricultural activity depletes the stock and/or quality of this public good, compared to an undisturbed environmental state. However, certain management practices can result in significant improvements to water quality and contribute to sustainable water use. These include, for example, the creation of reed beds along river valleys to improve water quality, converting arable land to grassland, retaining economically redundant terraces in Mediterranean valleys, extracting less groundwater for irrigation purposes than entitlements allow, or reducing drainage levels to slow run off from farmland.

Both the quality as well as the availability of the Europe's water resource demonstrates both private and public characteristics. There is private control over the usage of water, although the rights to water extraction vary between Member States. There may also be some private interest in ensuring that pollution of water courses is minimised, for example, to ensure healthy fish stocks in rivers or lakes, or to provide uncontaminated drinking water for livestock. However, given that water is a limited natural resource, there is a significant risk of over-exploitation leading to the depletion of the collective resource, and these risks are likely to be exacerbated in the future – particularly in southern regions of Europe – as precipitation rates fall, leading to more intensive periods of drought.

The longer term benefits associated with a high quality water resource and the availability of water are both non-excludable and non-rival and as such, water quality and water availability can be viewed as public goods. Ensuring the supply of these public goods requires government action encouraging sustainable water use and targeted towards limiting the contamination of ground and surface water to ensure a clean drinking water supply both now and in the future, in order to underpin human health, to support food production, and to sustain a whole range of ecosystem services.

2.2.4 Soil Functionality

The quality of agricultural soils is judged in relation to a range of parameters which include the proportion of organic matter, the level of susceptibility to erosion by wind and water, the soil's structure and capacity for infiltration, the health of its biota and its level of contamination (JRC, 2009a). Agriculture impacts on most aspects of soil health and quality given that most, although not all forms of agriculture, involve utilisation of the soil as a growing medium, source of nutrients, and as a resource for breaking down wastes. Under certain natural and climatic conditions, any form of agriculture is less favourable to soil quality, compared to an undisturbed environmental state, although the abandonment of agriculture in certain dryland areas could lead to a higher risk of soil degradation in contrast to when the land was under agricultural management. Soil functionality can be significantly improved, however, with the application of appropriate management practices.

Soil has the characteristics of both a private and a public good. As an agricultural resource, it is subject to private control and ownership and thus is both rival and excludable. Whilst it is in the land manager's private interest to manage the soil resource in an environmentally sustainable way, there is also often a short-term incentive to maximise productivity, with practices such as heavy pesticide and fertiliser use and inappropriate cropping methods, undermining soil quality and leaving soils in a degraded state over the longer term. Society has an interest in the retention of functioning soils at the present time and for future generations, not just as the basis for food production, but also to underpin the provision of public goods, such as carbon sequestration, biodiversity protection, water management and landscape. The longer term benefits associated with highly functioning soils are both non-excludable and non-rival and as such, Europe's soils can be viewed as a public good. Maintaining and improving the functionality of agricultural soils therefore requires government action.

2.2.5 Climate Stability (Carbon Storage and Greenhouse Gas Emissions)

The societal interest in slowing the rate of global warming is large for the sake of both current and future generations. Climate change mitigation encompasses all activities which are designed to slow or reduce the total climate change effect, through a reduction in the rate of release of anthropogenic greenhouse gas emissions or by enhancing the storage of carbon through sinks (IPCC, 2002). A stable climate is one of the purest public goods as the benefits are universal. Both carbon storage and a reduction in greenhouse gas emissions – the two key elements of a climate change mitigation response – have strong public goods characteristics, as no-one can be excluded from their benefits and there is non-rivalry in consumption. Whilst the sector is a net contributor of greenhouse gas emissions, a range of agricultural practices promote carbon storage and certain agricultural outputs can be used as renewable energy sources to offset fossil fuel consumption and thus greenhouse gas emissions throughout the wider economy.

Soils can either be a source or a sink of carbon. To maintain their role as a net sink, the rates of depletion of carbon from the soil need to be minimised, and its absorption capacity, and thus its sequestration potential, maintained or enhanced. Soil carbon content depends on the rate of addition of carbon from plant growth against the rate of removal through cropping, and by the decomposition of organic matter, leaching and other soil related processes such as disturbance and erosion. As such, the extent to which carbon is stored depends on factors such as soil type, moisture conditions, vegetation patterns and cultivation practices (UNEP, 2009). The sink potential is highest when there are minimal levels of soil disturbance and low rates of decomposition of soil organic matter, however, there is a wide variation in the sequestration potential of soils in different regions (Freibauer *et al*., 2004).

A large proportion of the climate change mitigation potential of agriculture arises from soil carbon sequestration (IPCC, 2007a) although the realisation of this potential depends on the type of agricultural management practiced. Certain forms of agricultural activity promote the storage of carbon in terrestrial carbon sinks up to a saturation point - with the exception of peat which will continue to accumulate organic matter and thus sequester carbon indefinitely if in good condition - often leading to improvements in soil structure and a reduction in flood risk at the same time (Watson *et al*., 2000; Smith, 2005). The carbon sequestered in agricultural soils is not stored permanently, however, and many forms of agricultural management lead to rapid releases of stored carbon. Indeed, if beneficial management is reversed or discontinued, the carbon is lost at a much faster rate compared to its rate of accumulation, leading to a swift and significant reduction in the carbon sink.

In the course of agricultural production, greenhouse gases, including ammonia, nitrous oxide, methane and carbon dioxide are emitted through the use of inorganic fertilisers and manures, machinery and in livestock rearing. Society does not have the option to reduce the emissions of greenhouse gases from agriculture to zero, however, there are a wide range of practices which can reduce total emissions, through manure management, more timely and efficient use of fertilisers, the modification of livestock feeding strategies, changes to water, nutrient and tillage management and by reducing dependency on fossil fuels.

2.2.6 Air Quality

The benefits to human health arising from air that is free from a range of pollutants are felt at a broad societal level. Air of high quality is one of the purest public goods, as it is impossible to exclude anyone from accessing clean air where it exists, and one person’s enjoyment of it does not impact upon that of others.

Agriculture is a source of a greenhouse gas emissions as discussed above, as well as particulates from diesel engines, smoke from burning straw or wastes, odours from livestock production, and contamination from spray drift, all of which reduce air quality. Some of these emissions are local, small scale and relatively infrequent, whereas others are relatively pervasive in certain forms of production. Minimising contamination from these various sources, however, can be achieved through the adoption of specific management practices.

2.2.7 Resilience to Flooding

It is projected that global warming will intensify the hydrological cycle and increase the occurrence and frequency of flood events in large parts of Europe, although estimates of changes in flood frequency and magnitude remain uncertain (EEA, 2008). Such extreme weather events will impact on agricultural productivity, with the impacts most severe in floodplains and low-lying coasts - often some of the most agriculturally productive areas. The risks are exacerbated in those areas where rivers and other watercourses have been straightened, which increases the speed of the water's flow, where riparian vegetation has been removed, and on highly compacted soils leading to fast rainfall run-off (LUC, 2009). Agriculture, however, can also form part of a mitigation strategy, with certain forms of land management improving the water storage capacity of the land and hence, the resilience of the broader landscape to these risks.

The number of people at risk of flooding could rise from 1.5 million to 3.5 million in the UK alone over the next 60 years (Evans *et al.*, 2004) and whilst there is a private benefit to the farmer to reduce flooding, improved flood management - leading to protection against flooding events - is in the broad public interest. No-one in the affected area can be excluded from the benefits resulting from the minimisation or even the avoidance of flooding events, which are enjoyed by everyone (non-rivalry). Because flooding tends only to affect certain areas, the number of people who experience the benefits is also limited, and in this sense, resilience to flooding displays many of the characteristics of a regional or local public good.

Much of the management that farmers can undertake to reduce the risk of flooding on their own land will also reduce the risk of flooding to others. Improving the resilience of the landscape can be achieved through the adoption or retention of farming practices which improve soil structure and thus infiltration rates, by blocking drainage channels to improve permeability, for example, as well as through land use choices, such as the targeted creation of grass buffers, hedgerows or woodland strips which slow the passage of water, or through the retention of permanent grassland (LUPG, 2004; Defra, 2008). Whilst these management practices may go some way towards slowing the passage of water sufficiently to reduce flood heights and thus towards mitigating major flood events, they need to be adopted by a majority of farmers at the catchment scale to be effective.

2.2.8 Resilience to Fire

In the past, fire – both from natural and anthropogenic causes – has played a significant role in shaping the ecology of the Mediterranean region in particular, yet in recent years, the region has experienced an increase in the intensity and scale of the fires, with an estimated 600,000 – 800,000 hectares of forest burnt each year. While small-scale fires may form part of the natural dynamics of these valuable ecosystems, the current wildfire regime (the magnitude, timing and frequency of wildfires) has severe socio-economic as well as environmental effects, including the loss of biodiversity, a reduction in the capacity of these ecosystems for natural regeneration, and increased risk of soil erosion (WWF, 2003). With climate change, the threat of fire is likely to increase over time, given that this region is likely to experience higher temperatures, reduced precipitation rates and longer summer droughts.

There are many causes of fires resulting from a complex interplay of socio-economic factors and sometimes rapid land use change. Changes in human activity and land use practices all modify the fire regime resulting in changes to the composition and configuration of land cover at the landscape scale. Recent increases in forest cover in the northern Mediterranean Basin have been attributed, in part, to the abandonment of traditional agricultural practices - particularly in Spain, Italy and Greece - leading to the loss of open patches of cultivated land in a landscape increasingly dominated by scrub and forest, and of grazing livestock which traditionally would have managed the understorey (Mazzoleni *et al*., 2004). In their absence, there is no natural break to the fire and the risk of it spreading over large areas of land is significantly increased.

Given the extent of these fires, and the devastation they cause, improved landscape resilience to fire is in the broad public interest. Indeed, no-one can be excluded from the benefits of the avoidance of fire, which are experienced by almost everyone in the affected area (non-rivalry). Because fires tend only to affect certain areas, the number of people who experience the benefits is also limited, and in this sense, resilience to fire displays the characteristics of a regional or local public good. The continuation of appropriate forms of agriculture in these areas contributes to improving the resilience of the landscape to fire, as well as generating a range of additional benefits, including the maintenance of open landscapes, and the biodiversity associated with grasslands (Moreno *et al*., 1998).

2.2.9 *Rural Vitality*

Like landscape, 'rural vitality' is a composite entity - comprising social, cultural and economic dimensions - although the social viability of rural populations is perhaps central to the concept. In many parts of the European countryside, a critical social mass is important to sustain the services and infrastructure relied upon by rural populations, as well as serving as a repository of skills and knowledge which help to keep alive rural cultures and traditions.

In some parts of Europe, rural vitality continues to be closely underpinned by agriculture, however, this relationship has been weakened in other areas, where the size of the agricultural workforce is small and the sector no longer makes a significant contribution to the rural economy, with other sectors playing a more important role in sustaining a viable critical mass of people in the countryside. The link to agriculture is most significant in certain regions of Spain, Italy, Greece, and in the new Member States, with more rural-based populations, where agriculture continues to be one of the principal forms of permanent employment, exerting a multiplier effect up and down the supply chain.

Even in those countries where agriculture's contribution to the rural economy or the working population is small, agriculture often continues to play an important social and cultural role. Rural cuisine and customs, as well as the musical and literary traditions of many parts of Europe are often rooted in an agricultural heritage. They are valued highly both by local people as they help to sustain forms of social capital and strengthen the 'sense of place', and by society more broadly, as they foster a connection with a bucolic past. In addition, and in many parts of Europe, the rural tourism and recreation sectors depend heavily on the existence of cultural landscapes and farmland biodiversity sustained by certain forms of agricultural activity.

As such, the maintenance of rural vitality – and the specific agricultural practices and communities that underpin it – is in the wider public interest because of its importance in maintaining viable rural communities, in sustaining associated rural traditions and cultures, in fulfilling a broader societal desire for a counterpoint to urban life, and because of its role in promoting territorial balance. Its socio-cultural components, in particular, have the characteristics of non-rivalry and non-excludability to a considerable degree as many can enjoy the benefits that they provide, and there is little rivalry in consumption.

2.2.10 Food Security

As defined by the 1996 world food summit "Food Security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 2006). A recent study of global food security produced by the Economic Research Service of the United States Department of Agriculture (2006) found that in 2005, 777 million people out of a total global population of 6.7 billion were "food insecure", and the authors predict that the number of people affected will increase by 14 per cent over the next ten years.

Access to affordable and safe food is an important public good. Although markets are the best regulators of food supply, there are hazards arising from a potential shortfall in supply that do not arise with other commodities less central to human welfare. Indeed, there is a strong social preference for the avoidance of hunger and malnutrition in others, as a moral imperative predicated on the belief that no-one should be denied access to food and that there should be non-rivalry in consumption, which is different in nature from the fulfilment of personal satisfaction through consumption. As such, it can be argued that food security at a global scale is valued in a way that "security" is not in many other supply chains. There is also a significant option value associated with retaining the capacity for food production in light of the anticipated effects of climate change.

There are various reasons for food insecurity. Uneven access to food or food shortages is often the result of a lack of purchasing power or inadequate distribution both within and between countries, rather than the result of an absolute shortage in supply (Sen, 1997; 1999; Swinnen, 2009a). Indeed, global food production has risen three per cent per year over the past decade, surpassing population growth and leading to an increase in per capita food availability (USDA, 2006). These factors mean that the threat of food insecurity is disproportionately severe on food importing developing countries (Boddiger, 2007; Cabinet Office, 2008) and on a proportion of deprived citizens in EU Member States[3] (EU Commission Social Protection Committee, 2009). Absolute food shortages are not a strong probability in Europe – in the short to medium term at least – and there is sufficient wealth to purchase food from elsewhere if shortages appear or become more likely. The propensity to be risk averse with regard to food supply remains, but the overall level of risk is much lower at a European scale (for about 80 per cent of the European population) and the prospect of malnutrition more remote compared to most other parts of the world.

[3] A targeted programme for the free distribution of food to the most deprived exists within the EU, with 19 Member States currently participating in the programme.

Presuming that India and China continue to experience high levels of economic growth, their populations shift to a more meat based diet, corn and other arable crops are grown on an increasing scale for biofuel feedstocks and other energy requirements, and large scale crop failures become more common due to climate change, food prices may continue to rise. Indeed, agricultural commodity prices are expected to remain 15 – 20 per cent above the average of the previous decade (OECD-FAO, 2009) which is likely to boost supply, but will also affect the purchasing power, and hence nutritional intake, of people in the developing world and deprived citizens within the EU. Development policies which deliver faster and more evenly distributed economic growth and a fairer distribution of income will be critical to ensure the food security of these vulnerable people.

Against this global backdrop, the EU is both a major producer of food and the largest importer in the world at the present time. As a producer, it has considerable capacity of arable land in reserve, notably in the new Member States. As a temperate region with reasonably robust soils, the EU may be able to withstand the negative effects of climate change more successfully than many other parts of the world and thus it could become a more competitive supplier of several commodities in the longer term.

It is useful to recall that one of the five original objectives of the CAP as set out in Article 33 (39) of the EC Treaty refers to food production in Europe notably ‘to increase agricultural productivity’ and ‘to assure the availability of supplies’. That said, the challenges relating to food security do not appear to relate to shortages in supply - in the immediate future at least - and therefore the justification for significant increases in agricultural production in Europe on the back of arguments of food security is less robust than is often described. What perhaps is more critical in a European context, is to ensure the maintenance of a sustainable resource base, including safeguarding water supplies, managing the land to improve its resilience to flooding, maintaining soil fertility, and safeguarding the integrity and resilience of ecosystems – all public goods in their own right – as a means to secure the long term capacity of the land to produce food in Europe over the longer term (LUPG and BfN, 2007; BirdLife, 200; House of Commons Efra Committee, 2009; SDC, 2009). Coupled with this, it will be expedient to reduce dependency on fossil fuels, to protect land from excessive urbanisation, to retain a skilled labour force, and to invest in research and development to facilitate agriculture’s adaptation to climate change (Royal Society, 2009).

2.2.11 Farm Animal Welfare and Animal Health

Amongst the European public, there is widespread demand for high levels of farm animal welfare (Eastwood, 1995; DG Health and Consumer Protection, 2005), to avoid any unnecessary suffering or injury and to take account of the physiological and behavioural needs of animals. As such, although it is to some extent in the farmer's private interest to maintain high levels of farm animal welfare because this leads to healthy livestock and a high quality product, society is increasingly deeming the welfare of the animal to be a public good in and of itself, on the basis that farm animals should not be excluded from having access to appropriate living conditions according to their physiological needs, and that this access should be non-rivalrous. Certain approaches to livestock rearing, for example, which provide ample space for animals to express more natural forms of behaviour, provide welfare and environmental benefits, and in particular, outdoor grazing may reduce the occurrence of some diseases.

Good husbandry practices also provide a service to society by contributing to consumer safety and public health. Mandatory standards of animal husbandry codify not only society's minimum acceptable level of farm animal welfare and health, but also reflect the ambition of a society. This is certainly true for efforts to eradicate certain diseases with relevance for public health.

2.3 Alternative Means of Delivery

The public goods described in the preceding sections are all provided in association with particular forms of agricultural activity. A distinction has been made between those public goods – such as farmland biodiversity or agricultural landscapes – which are inextricably linked to agriculture, and those – such as a stable climate, resilience to flooding, and soil, water and air quality – which could be delivered through alternative forms of land use. However, it is often not a straightforward calculation of the degree to which the supply of a public good can be substituted directly through other forms of land use, as public goods provided through agriculture are delivered in conjunction with food and other materials, and often as a cluster of multiple public goods. Substituting supply through alternative forms of land use other than agriculture, therefore, may have adverse consequences for the simultaneous provision of multiple private and public goods.

The potential for substituting the supply of any given public good depends on a number of factors, including the extent to which it can be disassociated from agricultural production, and whether the goods supplied by non-agricultural activities are substitutes for those supplied by agriculture. Whether the supply of a given public good can be detached from agriculture at a reasonable cost, often depends on the extent to which there are technical or biological interdependencies in the production process between the public good and the agricultural commodity. In other words, if the production of the commodity and the public good are technically bound together - such as grazing and a grazing landscape - they cannot be produced independently, even though they may be produced in different proportions over time (OECD, 2001a; Blandford and Boisvert, 2005).

This provides a useful explanatory principle to understand the issues of substitutability in supply, but is does not always correspond to the complexities inherent in practical situations. Even where it is theoretically possible to provide the public goods traditionally associated with agriculture through alternative forms of land management, there are often a number of institutional factors which render this separation from agriculture undesirable (Hagedorn, 2004). Often, there are economies of scope which means that costs fall when the agricultural commodity and the public good are produced on the same farm. This is because the farmer has access to particular inputs, such as the land, that tend to reduce the costs of providing the public good, compared to a situation in which it is provided on land outside of the farm. The opportunity costs of a whole-sale change in land use may far exceed those of remunerating farmers for a reduction in production intensity commensurate with higher levels of public goods provision. From a public finance perspective, it is often not rational to separate the two.

In conclusion, the scale of provision of public goods on agricultural land is limited both by low elasticity in the supply of land and by the need to deliver private goods to the public (food, fibre, industrial materials) on a large scale. Neither the public nor the private good are ever likely to be supplied at optimal levels, and there will always be a degree of compromise in terms of the relative levels of supply. In meeting Europe's broad requirements for food and in achieving its social and environmental objectives, a balance has to be found between the intensity of supply of different public and private goods in line with society's interests in the broadest sense.

2.4 The Scope of the Study

A primary aim of the study is to examine where there is a case for supporting the ongoing provision of the main public goods associated with agriculture through some form of public expenditure programme (see Chapter 4). As demonstrated in this chapter, a wide range of public goods are provided through agriculture in the EU. Nonetheless, the scope of the study is confined to the following public goods as set out in Table 2.1 below.

Table 2.1 The environmental public goods that form the focus of the study

1	Agricultural landscapes
2	Farmland biodiversity
3	Water quality
4	Water availability
5	Soil functionality
6	Climate stability – carbon storage
7	Climate stability – greenhouse gas emissions
8	Air quality
9	Resilience to flooding
10	Resilience to fire

The reason for this focus on a coherent suite of environmental public goods is justified on a number of counts. First, many of the environmental public goods provided through agriculture are under threat, and yet at the same time they are highly valued by society (RISE, 2009). This renders them a priority for public policy, and the case for intervening via the CAP is strong. Whilst there are gaps in the evidence base with respect to these environmental public goods, there are more data available compared to public goods such as rural vitality and farm animal welfare, which are difficult to measure at the present time.

As such, the social public goods provided through EU agriculture are not explored further in this study, although future investment in defining these public goods and their relationship with agriculture, developing indicators to detect undersupply where it exists, and assessing the scale of public demand is clearly warranted to inform future policy discussions. Food security also does not receive further attention, as the primary causes of food insecurity at the present time – in a European context at least – are not related to a shortage in supply, and therefore the challenge to be addressed is that of securing equitable access to safe and affordable food for which other forms of public intervention are more appropriate.

Having discussed the most significant public goods provided through agriculture in the EU, Chapter 3 examines those types of agricultural activity which provide both a wide range of public goods and improve the condition of specific environmental public goods, exploring the key factors that give rise to these beneficial outcomes.

3 FARMING PRACTICES AND SYSTEMS ASSOCIATED WITH THE PROVISION OF PUBLIC GOODS

3.1 Introduction

A wide range of agricultural activities provide a range of environmental public goods in Europe. This provision is far from uniform with respect to any single public good, and is not constant over time. The purpose of this chapter is to review the factors that explain the varied patterns in the provision of public goods, and to identify those types of agriculture that make the greatest contribution on a European scale, and have the potential to lead to higher levels of provision in the future. Evidence is drawn from the literature, the case studies and an assessment exercise of beneficial farming systems and practices undertaken expressly for this study by a group of experts.

No comprehensive account of the provision of public goods by diverse farming operations in the EU is available and it would not be possible to compile within a short period of time. Consequently, in order to offer an overview, some aggregation and simplification of farming activities and their relationship with the environment is essential. This has been achieved by focusing on farming systems, which reflect the principal types of agricultural land use.

The environmental public goods under consideration differ in some important respects. However, a number of characteristics of agriculture are of particular relevance to the provision of public goods in Europe. These are:

- The crop cover and agricultural land use in a broader sense.
- The practices applied (including inputs used, varieties of crops or livestock selected, types of machinery employed, etc.) and their sensitivity to the local environment.

- The farming systems being followed[4].
- The size and structure of the farm, including size of fields, scale of operation.
- The agricultural infrastructure in a locality, including drainage and irrigation.

These characteristics go a considerable distance in determining how far agriculture contributes to the provision of public goods, but it is not only the current farm management that determines the environmental outcome. In addition, both locational factors and previous practices need to be taken into account for certain public goods, for example, where the maintenance of historic landscape features is concerned. Such spatial and temporal dimensions are of importance for the overall pattern of supply but are discussed only briefly in this chapter since they are difficult to generalise at a European level. Consequently the analysis presented here focuses on current farm management and in particular, on the practices and systems being employed, together with the structures in place.

3.2 Agricultural Practices

Agricultural operations can be broken down into a series of practices, covering the spectrum from seedbed preparation, through the application of nutrients and management of livestock, to the harvesting of crops, disposal of wastes, and management of landscape features, such as hedges and ditches. The precise timing and spatial extent of a particular operation, as well as its use, may be of significance in terms of environmental outcomes. Many practices are widespread, although they will be subject to discrepancies and individual variations from farm to farm, and between regions and climatic zones. Some practices, previously widespread, are no longer common as more efficient alternatives have arisen and may be classed as "traditional". Others are confined to particular regions or production systems or are uncommon because they require a particular farm structure, level of skill or substantial investment. Most are pursued because they are considered necessary for the agricultural production cycle but some are adopted largely or wholly for their environmental value, such as maintaining patches of wildlife habitat in field corners.

Whilst a large number of practices can, in principle, contribute to the provision of public goods, no comprehensive overview of such practices currently exists

[4] For the purposes of this study, a broad typology of farming systems has been used, referring to the main crop or output, whether livestock are involved and, in some cases, the degree of specialisation or intensity. Different practices are associated with particular systems to varying extents and a few systems are driven by an overarching philosophy, such as organic production. Systems, in short, are more than a collection of practices, since they are often interdependent.

for the EU as a whole. An analysis was therefore undertaken for the study, to provide an EU-wide overview of those practices and systems which provide public goods at the present time in order to identify those of particular environmental value (see Annex II for a detailed description of the rationale for this assessment exercise, its aims, the methodological approach and the results). This draws on the literature and case studies (see Annex I which sets out where the case studies were undertaken and their agricultural focus), supplemented with expert interviews. Practices which have been selected as appropriate for payments under agri-environment schemes in a range of countries were a primary source for this exercise. Many practices provide more than one environmental public good, often to different degrees. More efficient irrigation techniques, for example, make a direct contribution to sustainable levels of water abstraction, but they may also require less energy and hence lead to a reduction in greenhouse gas emissions. Others may conflict with the supply of other public goods, for example, high milking frequency may enhance carbon efficiency in dairy production but be associated with intensive systems of little value in biodiversity terms. Many practices can occur in several different farming systems and contribute to a variety of public goods. The application of low levels of nitrogen fertiliser is relevant both to water quality and the reduction in greenhouse gas emissions.

As part of this exercise, a total of sixty-six agricultural practices were selected as being directly associated with the provision of public goods. Each practice was separately assessed, to capture the linkage between the farming practice and the ten environmental public goods outlined in Chapter 2. The assessment was peer reviewed by eight experts with detailed knowledge of different farming systems across the EU. Figure 3.1 lists the practices and ranks them by the number of public goods to which they contribute, or to which they could potentially contribute if they were adopted by farmers.

This list is not exhaustive but it demonstrates the considerable range of practices involved, both in the crop and livestock sectors, and their varied potential in improving the condition of different environmental media (Figure 3.1). Practices associated with moderating or reducing the use of inputs, which potentially have adverse environmental impacts, predominate. Management of landscape features and semi-natural vegetation is the purpose of another group of practices. Such an inventory is subject to change over time - emerging technologies will create new possibilities, for example, novel ways of improving energy efficiency - and there may also be scientific advances which enhance the environmental value of specific practices.

Nonetheless, two categories of practices can be identified as being most associated with the provision of public goods:

- Those that are inherently less intrusive on the environment, for example, those that do not involve deep cultivation, irrigation, heavy input use, the removal of semi-natural vegetation, etc. Many correspond to more

traditional extensive practices but also include some modern ones (for example, drip irrigation).
- Those that are designed to address a specific environmental concern, for example, the use of buffer strips, skylark scrapes, or slurry injection.

Given the character of these practices, and their association with diverse farming systems and circumstances, it is evident that they are not evenly distributed across the farms of Europe, leading to a variation in the provision of public goods across different farming systems and regions. However, many of the patterns are difficult to observe at this level. They emerge more strongly if a smaller range of selected farming systems are considered.

3.3 A Classification of Farming Systems in the EU

A simple classification of farming systems in the EU was devised for this study, reflecting differences in land use and production intensity as well as the principal types of crop (Table 3.1). Given the focus on environmental public goods the distinction between intensive and extensive systems is a key element of the classification. This can be defined in various ways, generally referring to either the level of inputs used, or the outputs produced per unit area, or both. With grazing livestock, the density of animals kept per hectare of forage is a common measure of intensity. It is difficult to propose any precise thresholds between intensive and extensive production in what is effectively a continuum, influenced not just by the farmer's choice of system, but by the soils, climate and existing vegetation.

Table 3.1 A classification of the main farming systems in the EU

<table>
<tr><th>Livestock</th><th>Arable</th><th>Mixed</th><th>Permanent Crops</th><th>Specialist Field Crops and Horticulture</th></tr>
<tr><td rowspan="2">Permanently housed intensive livestock</td><td rowspan="3">Intensive arable</td><td rowspan="3">Intensive mixed arable/ pastoral</td><td rowspan="3">Intensive permanent crops</td><td>Horticulture under glass</td></tr>
<tr><td rowspan="3">Horticulture field crops</td></tr>
<tr><td rowspan="3">Intensive dairy/ beef/ sheep</td></tr>
<tr><td rowspan="4">Extensive arable</td><td rowspan="4">Extensive mixed arable/ pastoral</td><td rowspan="4">Extensive permanent crops</td></tr>
<tr><td rowspan="2">Rice</td></tr>
<tr><td rowspan="2">Extensive outdoor livestock and silvo-pastoral</td></tr>
<tr><td>Legumes, pulses, field vegetables</td></tr>
</table>

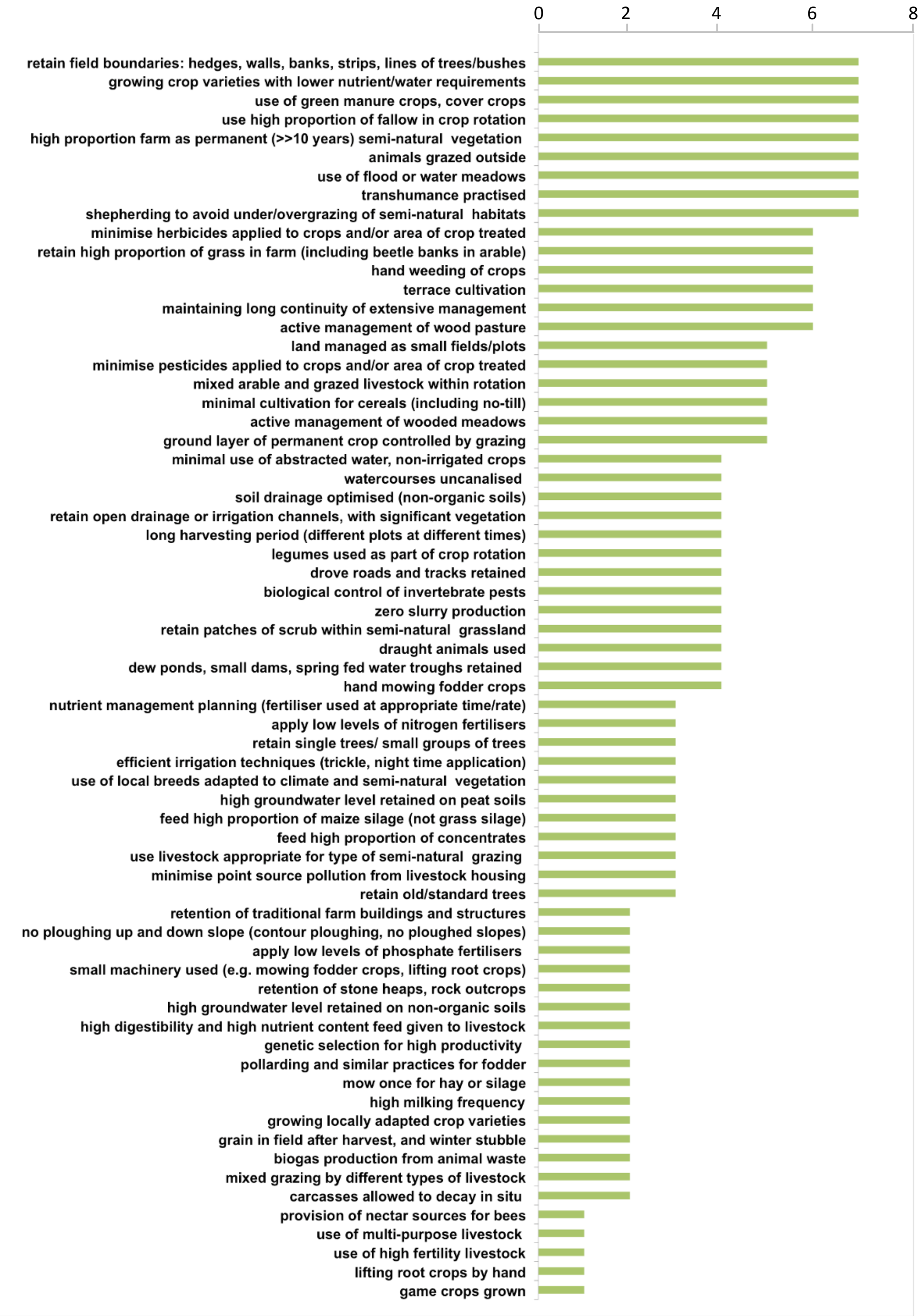


Figure 3.1 **Farming practices ranked by the extent to which each practice provides one or more categories of public goods***

* See Annex II for more detail

There is no definitive map showing the distribution of these systems in Europe but some impression can be gained from Figure 3.2 which shows the principal agricultural land uses in Europe in 2006 based on Eurostat Farm Structure Survey (FSS) data. This is most useful in showing where grassland and permanent crops are concentrated. Areas dominated by forest are not distinguished separately from arable land, so whilst Finland and Sweden are shown as predominantly arable, the proportion of land cover actually devoted to this form of production is relatively small in these heavily forested countries.

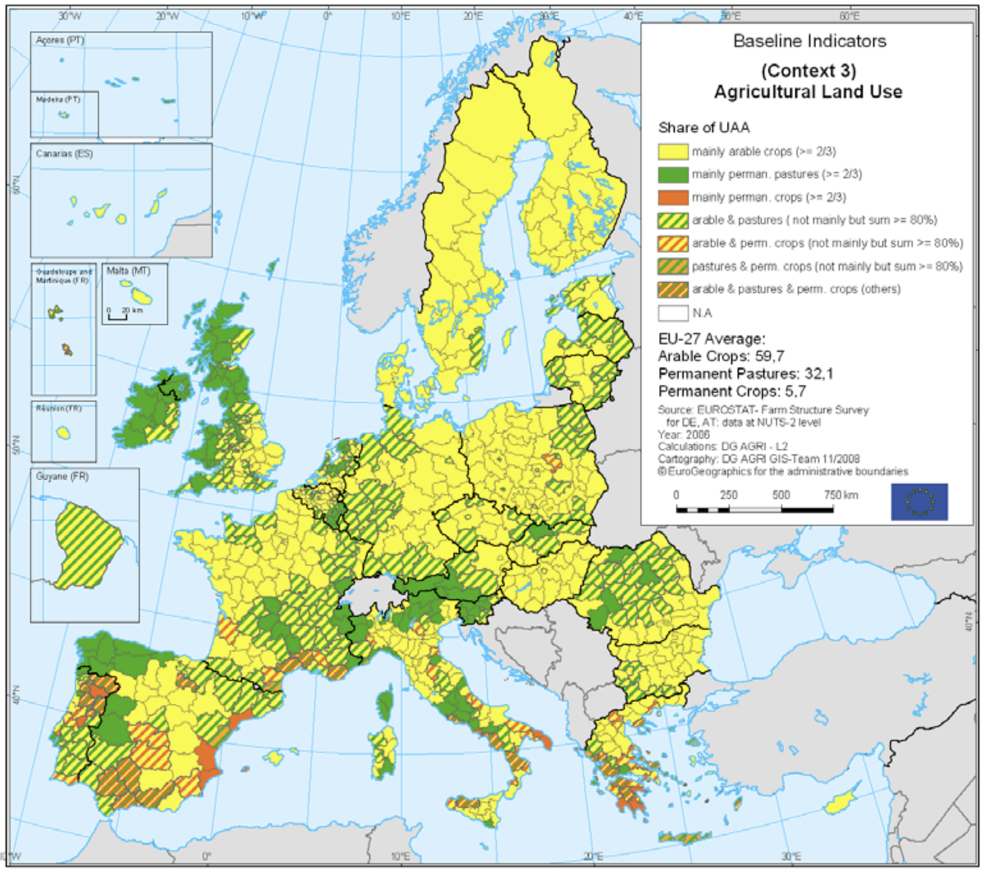


Figure 3.2 Agricultural land use in the EU

Source: Eurostat Farm Structure Survey

Some of the most relevant distinguishing typical characteristics of particular systems are outlined below, however, it is recognised that systems will vary in their form of management and in intensity from one region of Europe to another.

3.4 Livestock Systems

Intensive Dairy / Beef / Sheep

Intensive ruminant livestock systems mostly depend on cultivated temporary grassland where forage yields are generally far higher than those of semi-natural grasslands. Stocking rates and yields per forage hectare are much higher than in extensive systems, and modern single purpose beef or dairy breeds are used. Winter fodder is grass or maize-based silage, cattle (and in some cases sheep) are housed in winter and most manure is produced in the form of liquid slurry rather than mixed with straw or other bedding as is typical of extensive systems.

Extensive Outdoor Livestock and Silvo-Pastoral Systems

Low-intensity beef and/or sheep systems utilise lower yielding forage areas which include semi-natural, semi-improved and improved grassland both on the farm holding and sometimes on other land (such as commons) at densities as low as 0.15 Livestock Units per Hectare (LU/ha) to 0.6 LU/ha. The most extensive systems, based on cattle, sheep, horses or goats utilise semi-natural vegetation with seasonal transhumance still found locally. These grazed semi-natural habitats may have been used over very long periods of time by local breeds of livestock well adapted to local conditions (Beaufoy *et al.,* 1994). There is little use of mineral fertilisers or pesticides and the most important source of nutrients is manure from the livestock. Some extensive outdoor pig production systems survive, closely associated with woodland, notably on the *dehasas* of southern Spain and *montados* of Portugal (savannah-like grassland with scattered oak trees).

3.4.1 Provision of Public Goods by Livestock Systems

Whilst there is a wide range of livestock systems in Europe and management methods are changing over time, a general pattern in the provision of public goods can be perceived. Few public goods are associated with intensive indoor production systems, the principal exception being the capacity to produce pig and poultry meat, eggs and other products efficiently in terms of energy use and with less output of greenhouse gases per unit of output than in grazing cattle and sheep (Monteny *et al.,* 2006). At the other end of the spectrum, low intensity grazing systems are the principal form of management of large areas of valued pastoral landscape and critical to the maintenance of “High Nature Value” farmland in Europe (Baldock *et al.,* 1993; Andersen, 2003; Beaufoy and Cooper, 2008).

Pastoral landscapes, predominantly pasture, but including areas of grazed maquis, heath, scrub, woodland and accompanying meadows and fodder crops, are amongst the most characteristic and widely appreciated in Europe. They make up a large proportion of farmland in National Parks, protected landscape areas and the most picturesque and visited stretches of upland and mountain areas. They also include delta and coastal areas, dry plains and marshland (see Figure 3.3). The grazing of livestock was responsible for the creation of these landscapes and continues to be critical for their maintenance (Baldock *et al.,* 1996). In some cases, the landscapes are open and unbounded. In others, there is a pattern of hedges, ditches, walls, trees and patches of scrub, traditional barns and other elements, most of which once had an economic purpose even if this is not always the case today.

Extensive Livestock - Svartåmynningen, Sweden

Clean, Sustainable Water Supply
- Unirrigated
- No herbicides or non veterinary pesticides used
- No manure or fertiliser applied to semi-natural pastures.

Flood Control, Erosion Control
- No interference with natural flooding by sea; saltmarsh protects inland areas from inundation and erosion
- No wind or down-slope erosion threat
- Maybe some poaching on wetter ground.

Biodiversity
- Vegetation all permanent pasture (two Habitats Directive habitats), managed at medium to high intensity producing low sward attractive to wildfowl
- Little use of herbicides, pesticides limited to animal parasite control.

GHG Emissions
- On this pasture, natural dunging only, reducing denitrification risk.
- Soil may be wet, creating denitrification hazard, but helping to prevent oxidation of soil organic matter.

Figure 3.3 Extensive livestock systems provide a range of public goods

Photograph: Östergötland County Board.

Such landscapes are associated with beef cattle, particularly suckler herds, dairy systems, sheep for both meat and milk production and, in some areas, goats or horses. Each system has its own requirements and imprint on the landscape but the highest landscape values are often associated with the more extensive grazing systems, particularly by smaller, hardier sheep and cattle, including traditional or local breeds which are usually better able to exploit coarser and more natural vegetation and can themselves add to landscape value (Gandini and Villa, 2003). Indeed, more remote pastures in some regions, particularly in Spain and other parts of the Mediterranean, still rely on transhumance to bring in stock for summer grazing (De Juana *et al.,* 1993).

The cultural and archaeological heritage is often well preserved in extensive systems because low stocking densities have resulted in relatively little structural change or soil disturbance. Hedgerows, field margins and drainage ditches along boundaries are often present in lowland beef and dairy systems, perhaps at a lower density where the management is more intensive. In many of these more intensive systems with less diverse habitats, there is scope for enhancing landscape value, for example, by laying and managing hedges, and maintaining traditional buildings.

In extensive systems, grazing at levels which remove only the annual growth increment, and with very low or no agrochemical inputs, helps to maintain a wide range of species rich semi-natural vegetation. Traditional breeds are often well suited for this role (Rook *et al.,* 2004). For example, a study using FADN data to classify farms in 100 regions of the EU-15 Member States found particularly high ecosystem values with low management intensity (Reidsma *et al.,* 2006). Approximately 33 habitats of European importance and on average 18 per cent of all land in Natura 2000 sites in the EU-15 depend on the continuation of extensive pastoral management (EEA, 2005a) (see Box 3.1). Where the risks of abandonment are high, the continuation of extensive grazing practices is particularly important both to maintain the rich biodiversity and to prevent the fragmentation of such habitats (Baldock *et al.,* 1996; Silva *et al.*, 2008). For example, hay meadows and wood meadows are some of the most species-rich grasslands in Europe, but depend on very low levels of fertilisation and a cutting regime which allows the plants to set seed. As well as grazing stock, habitats traditionally managed by outdoor pigs kept in wooded landscapes are often rich in biodiversity whether on the floodplain woodlands of the Sava, in the ancient oak groves of the English New Forest, or the holm oak dehesas of Spain (Beaufoy *et al.,* 1994).

Box 3.1 Agricultural land use within Natura 2000 Sites

The Natura 2000 network covers some of the most valuable land for biodiversity in Europe. It was created by two EU nature conservation Directives, concerned with birds and habitats respectively. The aim is to protect priority species and habitats, currently comprising 23,685 designated sites in the EU-25, with terrestrial areas covering 788,000 km^2. By December 2008, the network was largely complete in only five Member States (Belgium, Denmark, Germany, Italy and the Netherlands), with networks in all other Member States either categorised as ‘incomplete’ or in the case of Bulgaria, the Czech Republic and Romania as ‘notably insufficient’ (DG Environment, 2009).

Approximately 15 million hectares of land in Natura 2000 sites, are under agricultural management in the EU-25, as illustrated in Figure 3.4, approximately 11.5 million hectares of which are found in the EU-15 Member States, equivalent to 35 per cent of the total land area within Natura 2000 sites. The proportion of land under agricultural management is considerably lower in the new Member States (EEA, 2006a). Within these sites pasture is the dominant agricultural land use, with only a small area under permanent crops or irrigated arable land. These grassland habitats of European importance account for more than 18 per cent of the total area of grassland in the EU-27.

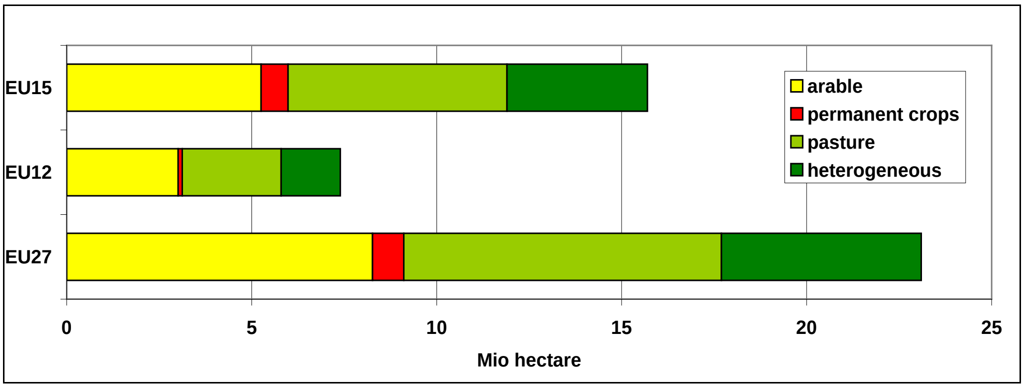


Figure 3.4 Area under agriculture within Natura 2000 sites

Source: Natura2000 data base (European Commission, DG Environment), CORINE Land Cover data 2000, own calculations.

More intensive livestock systems, including most dairy farms, are typically reliant on high yielding and quite heavily fertilised reseeded grassland or fodder maize. That said, even intensive dairy farms have the potential to deliver biodiversity benefits if heifers are raised because heifers do not depend on high quality forage and offer the opportunity to manage the forage areas more extensively. Habitat interest and diversity can be increased by reducing fertiliser and stocking rates, managing features such as hedges and establishing new ones, such as farm ponds. Where traditional field boundaries and trees have been retained, these often make the most significant contribution to biodiversity, as has been shown for the hedgerow landscapes of south west France (Le Coeur *et al.,* 2002).

On the floodplains, both intensively and extensively managed grassland can contribute to flood water storage during peak flows (O'Connell and Ewen, 2007), and to maintaining an open landscape, and hence reduced fire risk. For example, grazing of understory vegetation close to and within dry woodland and scrub areas, especially in the Mediterranean, can increase resilience to fire by removing combustible material and creating a fire barrier.

On permanent pasture, soils are not exposed to tillage and the risks of erosion, with consequent benefits for maintaining soil functionality. The relatively high organic matter content of grassland soils has a beneficial effect on soil biota, infiltration rates and carbon storage. On vulnerable soils and areas where the avoidance of water pollution is a priority, the conversion of arable production to permanent grassland is often a desirable change (Joint Research Centre, 2009). Nonetheless, there are risks of soil damage where livestock are kept, most notably from over-stocking, which in severe forms is harmful to soil structure and can precipitate erosion, particularly in hot spots, such as around feeding areas, gates and tracks. Maintaining the movement of stock is also important - skilful stockmanship, rotational grazing and shepherding can improve the value of soils and vegetation even in very extensive systems. Compaction can also be a concern on farms where stocking rates are too high. This can lead to rapid water run off and increase water pollution hazards. Reducing stocking rates and improved management are again the key to protecting the soil resource over the long term. The cultivation of forage crops for livestock raises different soil management issues. Maize, for example, needs to be planted on suitable ground, avoiding steep slopes and managed well to prevent erosion.

Livestock systems have a range of impacts on water quality. Run-off of soil and nutrients into water courses generally is less on permanent grassland than on arable land, and low intensity grazing on permanent pasture is widespread in upland and mountain catchments feeding urban water supplies. However, livestock are a source of several pollutants including slurry and other wastes, with dairy farming a significant source of water pollution, including waste from milking parlours and slurry spread over fields (Hooda *et al.,* 2000). Risks are greater where livestock are managed intensively, nonetheless in all systems, there is scope for reducing pollution loads and improving water quality. Amongst the options are reduced stocking rates, nutrient budgeting, the capacity to handle slurry efficiently and in a timely way, and to store it over the winter months, efficient application systems, such as slurry injection and buffer strips along water courses. In Lithuania, a study of eleven sites showed that permanent pasture managed with medium grazing intensity and no nitrogen fertiliser is an effective way of reducing nitrate content in drainage and upper groundwater (Mašauskas *et al.,* 2006).

Wastes from livestock production can also be a source of air pollution including ammonia and odours. These are most pronounced from high concentrations of livestock particularly in housed conditions, where large quantities of slurry are produced, although they can be reduced by appropriate management and investment, for example, in the handling, storage and application of slurry (Mackie *et al.,* 1998). Extensive grazing systems intrude least on air quality since large concentrations of stock are less common.

Box 3.2. discusses GHG emission from agriculture. Ruminant livestock release significant volumes of methane, produced during enteric fermentation.

Comparisons of GHG emissions per kilogramme of meat or milk produced show that ruminants grazing semi-natural grassland at low stocking densities release larger quantities of methane per animal and therefore per kilogramme of product than livestock on intensively managed grasslands. This is because the semi-natural vegetation is grazed at a more mature stage when it contains higher concentrations of cellulose, the essential substrate for methane production. Methane emissions per hectare are lower with fewer stock (Grayson, 2008).

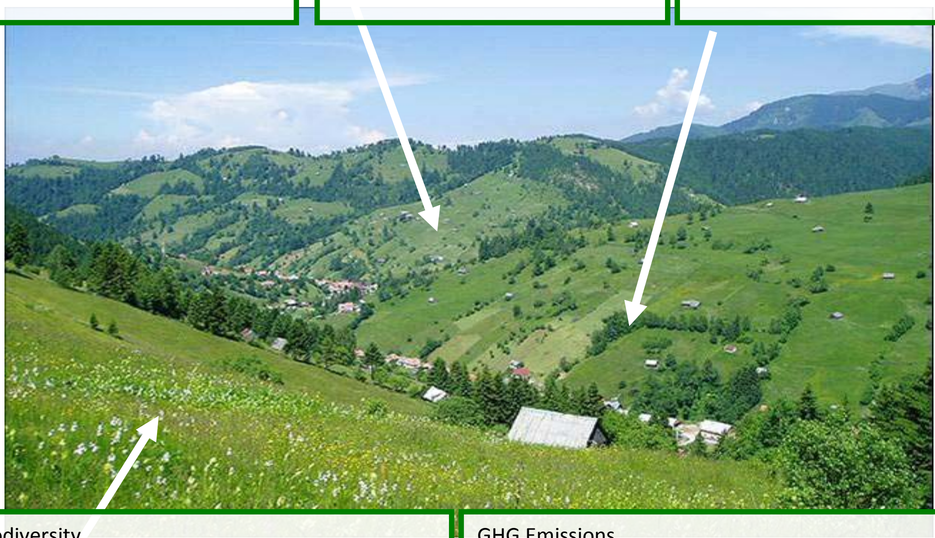
Most of the carbon stored in grasslands and other grazed vegetation is in the soil (Lal, 2004). All livestock systems contribute to carbon storage to some degree, however, semi-natural grasslands are often less effective at sequestering carbon in the short-term compared to more productive sown/improved grasslands because the higher yields are accompanied by increased root biomass and soil organic matter, which are critical determinants of carbon sequestration (Conant *et al.,* 2001).

Extensive Livestock - Moieciu de Sus, Brasov, Romania

Clean, Sustainable Water Supply
- No use of irrigation
- No pesticides or herbicides used
- Manure dressing on meadows and pastures is light.

Flood Control, Erosion Control
- Permanent pasture on slopes – soil not exposed to erosion agents
-Livestock housed in winter avoiding danger of poaching.

Cultural Landscape
- Walls, hedges, farm buildings
-Historic field patterns, over 450 fields in one valley.



Biodiversity
- Vegetation mostly permanent grassland managed as meadows and pastures, including 3 habitats of Community Interest and supporting at least 46 species of butterfly, 3 on the Romanian Red List and a further 5 on the European Red List
- No herbicides used.

GHG Emissions
- Dung applied mostly by hand as farmyard manure; denitrification unlikely to be an issue
- Very efficient in terms of energy use – little or no use of fuel, nitrates or concentrates.

Figure 3.5 Semi-subsistence pastoral farming provides a range of public goods

Photograph: Sally Huband

Other practices which lead to reduced methane production from livestock include the use of maize silage rather than grass silage, the selection of breeds with high fertility rates and productivity, and higher frequency of milking (fewer animals required for the same output).

Box 3.2 Greenhouse gases and agriculture

Agriculture contributes about nine per cent of total greenhouse gas (GHG) emissions within the EU, consisting of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The range is from two per cent in Malta to 26 per cent in Ireland (CEC, 2009). Each of these gases is involved in those natural cycles most associated with biotic activity, notably those of carbon and nitrogen. Green plants photosynthesise carbon dioxide into carbohydrates and provide a store during their life. If they are preserved as humus, peat or coal, this store is maintained after their death and can be released through the drainage of peat or the use of fossil fuels.

Gases produced as by-products of anaerobic respiration include methane, produced primarily in the digestive systems of ruminants, and nitrous oxide, occurring through denitrification of nitrate in poorly drained soils, such as ricefields. Considered over 100 years, methane and nitrous oxide have a greenhouse impact 25 and 298 times that of carbon dioxide respectively (IPPC, 2007b).

The living world, cannot avoid participating in the production and consumption of GHG and some level of emissions is an inevitable consequence of food production. Since they usually involve perturbations of the 'natural' cycles, few systems of agriculture *decrease* the net emissions on GHG on a given area relative to natural biotopes or forestry. Nonetheless, some practices promote the accumulation of stored carbon or keeping denitrification to a minimum, for example, grazing peatlands and scrub, or mowing grasslands on floodplains, while also maintaining biodiversity and landscape character.

Total agricultural emissions are falling over time, owing to greater efficiency in a range of operations and a decline in cattle numbers. Between 1990 and 2006, gross value added in agriculture in the EU-27 rose by 11.4% while GHG emissions fell by about 20 per cent (CEC, 2009). Relatively small further reductions are expected with existing measures.

In most cases, however, agriculture will result in a net increase in GHG emissions. Maximising the efficiency in terms of net emissions of GHG per kg of food produced generally implies high yields per hectare and, in the case of livestock, a short production cycle using non-ruminants as well as optimised use of technology, animal and crop genetics. Many, but not all of these factors also lead to increased commodity output.

Agriculture can contribute to a net decline in global emissions by substituting fossil energy sources with bioenergy, mainly dedicated crops and by-products of food crops, where these can be produced with fewer emissions. "Second generation" biofuels, such as short rotation coppice, are significantly more efficient in this regard than traditional crops, such as sugar beet. However, the production of biofuel feedstocks displaces food production or forestry, therefore net impacts need to be considered carefully.

3.5 Arable and Mixed Systems

Intensive Arable

Intensive, high yielding arable systems are the main form of production of cereals, oilseeds, root crops, proteins and related crops in Europe. Cereals are the dominant arable crop, extending over a third of the Utilised Agricultural Area (UAA) in the EU. In 2007, just over 57 million hectares were cultivated for cereals in Europe (Agra Informa, 2009), and up to 75 per cent of the 3.8 million hectares of set-aside in 2007 is estimated to have been returned to production (European Commission, 2007). These crops now rely on mineral fertilisers for most nutrients and the extent of crop rotation has diminished, with fallow land now scarce in intensive systems. Farms and parcel sizes can both be large, taking advantage of highly mechanised farming systems.

Extensive Arable and Mixed Arable Pastoral

Low intensity arable systems are much less widespread and are usually found in association with extensive livestock in mixed arable/pastoral systems. The farms are mostly small scale, including semi-subsistence holdings. In Romania, for example, three quarters of the UAA is in holdings with an average size of 2.15 hectares (Redman, 2009). Agrochemicals are largely absent and the arable crops are usually part of a crop rotation, often including fallow. These systems are found in the interior regions of Portugal, Spain, Italy and Greece, and common in many parts of eastern Poland, Romania and Bulgaria. Cattle may be grazed or stall-fed, eating a mixture of fodder and arable crops (for example, grass, lucerne, arable silage, grains). Sheep and goats may graze stubble and fallows at very low stocking densities (<0.3LU/ha in Spain). Extensive arable-only farms are scarce, but do exist (for example on the *mese ta* of La Mancha, Spain), but even here a functional relationship with livestock usually remains (Caballero, 2001).

Intensive Mixed Arable / Pastoral

These farms have characteristics of both intensive arable and intensive livestock systems and may have several different production units on the same farm (for example, dairy and cereals) but they lack the close functional integration found in extensive mixed systems. Compared to intensive specialist arable farms, field sizes are often smaller and more landscape elements may be present, but grazing is likely to be on intensive, temporary grassland, and livestock may be housed (Bouwman *et al.,* 2005).

3.5.1 Provision of Public Goods by Arable and Mixed Systems

Arable systems are inherently intrusive on the natural environment, more so at the intensive end of the spectrum, but they vary greatly in their structure and the precise forms of management undertaken. At all levels of intensity there is scope to manage crops, soil, water and surrounding features in such a way as to improve the environmental impact.

The less intensive, more mixed and smaller scale arable farms have the greatest potential to provide more complex and varied landscapes, whereas large scale blocks of single crops, providing less landscape diversity, are widespread on the larger, higher yielding farms that dominate arable production. Where livestock, permanent crops or patches of fallow are interspersed with arable fields, characteristic local landscapes are created (Figure 3.6), with a higher density of field boundaries. However, extensive arable systems with significant areas of fallow or semi-natural vegetation, once widespread in Europe, are now rare and mostly confined to poorer soils in drier areas, such as central Spain and more mountainous zones, particularly in southern and Eastern Europe.

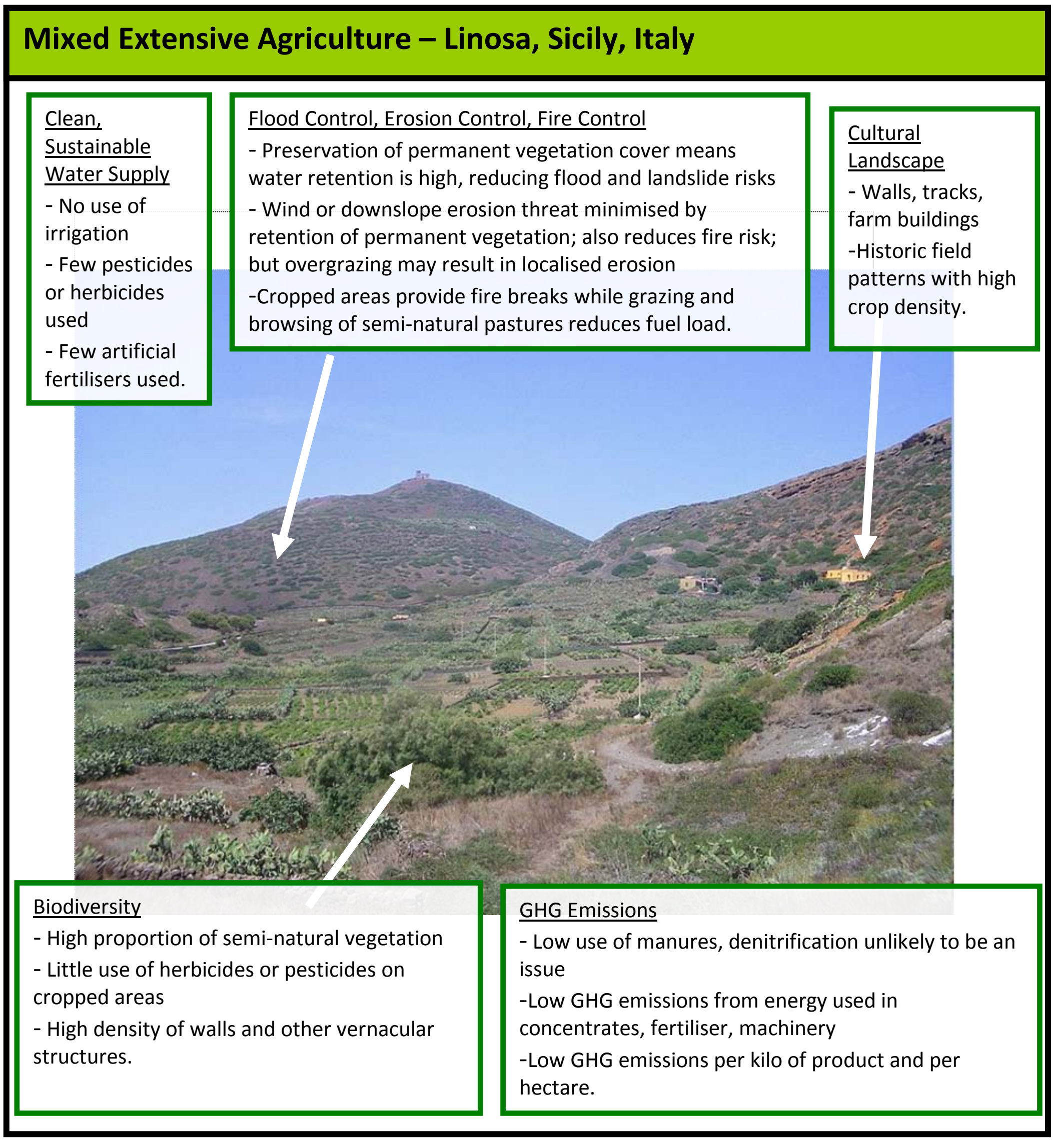


Figure 3.6 Mixed extensive systems provide a range of public goods
Photograph: Laurom

Biodiversity values follow a similar pattern, with the richest provision in areas of mixed and smaller scale arable and livestock production, including organic farms. This creates more favourable conditions for a range of species than the tightly controlled environment of specialised cereal units. Small scale fields, creating a greater density of boundaries and constraining the use of larger, heavier machinery also create more hospitable conditions for biodiversity (de Snoo, 1999). On the least intensive systems, with limited nutrient inputs and a high proportion of fallow, certain relatively rare species, including plants classified as arable weeds, can be found, provided that they are managed with environmental sensitivity with respect to cultivation techniques, use of inputs, management of margins, etc.

However, biodiversity interest can be enhanced in a variety of ways, even on larger, specialised holdings. Spring rather than winter sown cereals are beneficial for a number of farmland birds partly because of the feeding value of stubble remaining in the ground and also for insects (Reddersen, 1994). Buffer strips, fallow, the creation of micro habitats, such as skylark "scrapes" and varied crop rotations can create new niches and enrich the biodiversity of the cultivated fields as well as the field margins (Vickery *et al.,* 2002). Organic conversion and measures to reduce inorganic input use and minimise the use of pesticides also add to biodiversity value.

Soil cultivation, fundamental to arable production, increases the risk of erosion relative to permanent cover, but the precise form of management and local soil types and conditions influence the extent to which satisfactory soil quality, including organic content, structure and contamination levels, is maintained (Rasmussen, 1999). There are techniques to control erosion, for example, avoiding ploughing on steep slopes, ploughing along the slope rather than up and down, creating in-field ridges and buffers, and adopting a range of low or zero tillage techniques (Joint Research Centre, 2009). In some conditions, green cover crops and the careful timing of field operations are of particular value. The use of lighter machinery and well timed cultivation can help to avoid compaction. Organic content is declining in most European arable soils but the careful incorporation of straw, manure and other material can help to maintain or increase levels (Rusco *et al.,* 2001).

Since some soils are prone to erosion, even with good management, it may be necessary to create buffer strips and sacrifice areas to form a barrier to the movement of soils off the farmed area into ditches, roads and neighbouring properties. In certain sensitive areas, arable cropping in both intensive and extensive systems will need to be avoided to protect water quality or control erosion. Smaller field sizes and a greater concentration of hedges, windbreaks and grassy areas on arable farms will reduce the risks of water and wind erosion (Rodríguez, 1997).

Some of the same considerations apply to water quality where the risks of contamination of surface and ground waters tend to increase where cultivation occurs. Measures to control the leaching of nutrients and pesticides and the run-off of soils into watercourses, which is a significant source of phosphate pollution, are therefore a priority. In more intensive arable systems where tolerance of weeds or disease is low, inputs of nutrients and pesticides are relatively high to maintain yields. Of the 10.6 million tonnes of inorganic fertiliser applied to farmland in the EU in 2006/07, 54 per cent was applied to cereals, including maize and rice, and a further 22 per cent to other field crops, amongst them oilseeds, root crops and vegetables. Grassland, by contrast, accounted for 19 per cent and permanent crops 5 per cent (EFMA, 2009). Minimising the use of these inputs and matching them to crop requirements as closely as possible can provide both environmental and economic benefits.

There are many approaches to achieving this goal, including nutrient planning, precision farming techniques, "integrated" farming methods, and various forms of crop rotation and biological pest control. Some excess nutrients can be absorbed by cover crops following the cereal harvest and there are synergies between most techniques to conserve soil and to control water pollution. Buffer strips and headlands can reduce the leaching of nutrients into neighbouring watercourses and habitats. There may also be scope for growing crops that require less input of nutrients, such as durum wheat in the Mediterranean.

Irrigated systems tend to be intensive, with high input use and enhanced risks of water pollution (EEA, 2009a). Lower input systems and those using well adapted practices of the type summarised above will, in principle, contribute most to improvements in water quality. Emissions of greenhouse gases are also related to intensity, particularly of input use, along with other factors such as energy expended in crop drying. Low intensity and zero tillage systems perform better than the average. Factors which contribute to soil nitrogen and emission levels include the quantities of farmyard manure and inorganic nitrogen fertiliser applied, soil moisture and compaction. Wet and particularly anaerobic soils are associated with higher N_2O production, so improving drainage of mineral soils can help to reduce this.

Lowering the intensity of arable production will usually reduce the emissions of greenhouse gases per hectare, more so if the emissions embedded in fertiliser are included in the calculations. A variety of technical measures are also effective in this regard, including the increased use of leguminous crops for nitrogen fixing, adopting low or zero tillage techniques which are less energy intensive, and increased attention to the management of soils and crop residues such as straw which help to conserve organic matter and soil carbon.

Agricultural production of bioenergy can contribute to net reductions in greenhouse gas emissions if it displaces fossil fuels without entailing an equivalent set of emissions during the cycle of growth, processing and transport to the point of use (Smith *et al.,* 2008). Several energy feedstocks are associated with arable production, including conventional crops such as cereals and sugarbeet for bioethanol, oilseeds for biodiesel, maize for biogas and bioethanol residues such as straw and newer "second generation" crops, such as short rotation coppice.

Carbon sequestration occurs on arable and mixed farms soils, although compared to grassland farms it is limited by the cropping cycle and cultivation processes (Rees *et al.,* 2005). Ploughing well established grassland releases carbon on a considerable scale. Measures to minimise the depletion of soil organic carbon include reduced or zero tillage systems, the careful management of nutrients including manure, sewage and cover crops and the introduction of permanent crops, including trees into a predominantly arable landscape (Cooper and Arblaster, 2007). Certain soils, such as peatlands, which absorb significant quantities of carbon from the atmosphere, and emit little in return when they are actively growing, require special treatment (Defra, 2009b). There are opportunities to reverse the decline of peatlands, including reflooding in order to prevent oxidation. More generally, organic carbon content can be enhanced by converting arable land to permanent pasture, or other uses which do not entail regular disturbance.

Good soil management, including the avoidance of compaction and bare ground in winter, for example, through the use of cover crops and the protection of watercourses is probably the principal means of reducing flood risk, which is typically greatest in those areas where intensive arable cropping or grassland is found (LUC, 2009). Reducing the efficiency of field drainage to slow down the rate at which precipitation is carried to watercourses can also be effective where flooding is a major concern.

In summary, the overall intensity of management of arable systems is central to the public goods provided. Specialist arable systems operating on a large scale are highly productive but will contribute little to public goods unless they prioritise the type of management options discussed here, chosen in the light of specific circumstances. Mixed systems have the merit of creating variation in habitat and landscape and providing a direct use for livestock wastes. The most extensive mixed systems (Figure 3.6), offer perhaps the greatest range of public goods, partly because of their small scale and complexity. However, opportunities for improved arable management apply at virtually all scales.

3.6 Permanent Crops

Permanent crops include vines, orchard fruit and Mediterranean dryland tree crops, particularly olives. Of the 14 regions with permanent crops, accounting for over 30 per cent of their UAA, 10 are in the Mediterranean region (Eurostat, 2009a). Citrus fruits are concentrated in the Mediterranean countries, apples in Poland, Romania, Italy and France, and pears in Italy. Extensive tree crops are mostly characterised by full-size, older trees, widely spaced with permanent semi-natural or low intensity understorey vegetation. Traditional orchards occur locally in Spain, and are more widespread in Portugal, Italy and Greece. Estonia and the Czech Republic have relatively 'old' apple orchards with almost 60 per cent and 43 per cent respectively more than 25 years old (Eurostat, 2009b). In contrast, Belgium, Luxembourg and the Netherlands typically have 'young' apple orchards, where more than 60 per cent of the trees are under 10 years old. More intensive systems are based on higher yielding varieties, half standard or dwarf trees predominate, agrochemical use tends to be high and irrigation is not uncommon in southern Europe. Most vineyards are under intensive management but there is a growing organic sector. Increasingly, extensively managed orchards with low densities of old trees are being grubbed up, and the density of trees per hectare is higher in younger apple orchards, for example in Poland (Eurostat, 2009b).

Permanent crops are retreating in the landscape, with a 3.8 per cent reduction in area in the EU-12 between 1990 and 2000 (EEA, 2005b). The area of traditional orchards in Europe has been estimated at around one million hectares, in eleven or so temperate countries (Herzog, 1998). The biggest concentration is in Germany, thought to be between 225,000 and 500,000 hectares in 1995/97 and about 200,000 hectares in Poland, 180,000 in Romania and rather less in France (Robertson, 2008). Maintaining and augmenting traditional systems is a priority in many agri-environment schemes because of the diminished scale of the resource.

3.6.1 Provision of Public Goods by Permanent Crops

Permanent crops play an important part in cultural landscapes in many parts of Europe, whether it is vines in the Rhine valley, olives in Crete, or apples and damson trees in the Basque country. Often they provide variety and structure, frequently being grown alongside other crops, patches of grass and buildings. They range in scale from the individual tree to large monocultures over hundreds of hectares, from traditional full size trees, relatively spaced apart, to the modern high yielding varieties, which are smaller and more tightly packed. Beneath the trees there may be pasture, generally mown, grazed or unmanaged, or in some cases, bare ground to prevent the growth of competitive vegetation. Where this is the case, their biodiversity value is reduced and there is a greater hazard of soil erosion, particularly on sloping land.

Ecologically, where extensively cultivated, they resemble wood pasture and are a kind of agro-forestry system of considerable biodiversity interest. They are an important habitat for a wide range of species, including mammals, birds, insects, plants and lichens. A survey of four orchard areas in Rhineland-Pfalz found 2,391 species present, 408 of which were rare and / or endangered (Simon, 1992). Fruit varieties are an integral part of the biodiversity of traditional orchards, with an estimated 1,400 varieties of apples and 1,500 varieties of pears, cherries, walnuts and plums in Germany alone (Herzog, 1998). The wildlife of orchards depends on the mosaic of habitats that they encompass, including fruit trees, scrub, hedgerows, the orchard floor habitats, dead wood and ancillary activities such as apiculture and livestock grazing (Natural England, 2009).

These features are notably less abundant in more intensive orchards and permanent crops, based on different varieties, techniques and forms of land management, including heavy applications of pesticides. In these cases, the provision of environmental public goods may be improved by including more semi-natural vegetation and older trees in the productive area, curbing input use, adopting biological pest control, taking steps to limit erosion, allowing grazing where appropriate and other approaches to management that increase the diversity and resilience of the landscape.

In olive production, a distinction can be made between low-input traditional plantations and scattered trees, particularly valuable in landscape and biodiversity terms, intensified traditional plantations with more intensive weed control and soil management, and intensive modern plantations with smaller tree varieties, planted at higher densities and managed with more mechanised techniques, often with irrigation (Beaufoy, 2001).

Permanent crops vary greatly in the soil management techniques used. Where grass or other permanent vegetation occurs beneath the crop, the contribution to soil functionality and erosion control generally will be positive. Where there is bare soil on sloping ground there can be erosion hazards, and a need for appropriate preventative management including grass buffers, hedges, appropriate machinery use etc. Green cover has been shown to be important for controlling erosion in several studies of olive plantations in Spain (Pastor *et al.,* 1997; 1999).

Similarly water consumption varies greatly, with some traditional olives, figs and fruit growing in dry areas with no irrigation but with more intensive cultivation using significant volumes of water for irrigation. Some of the benefits of more extensive non irrigated systems are shown in Figure 3.7. Water pollution can arise from agrochemicals and nutrients applied to the crops, and may be significant in some intensive systems. Management of the crop, soil and boundaries are all relevant to reducing pollution loads.

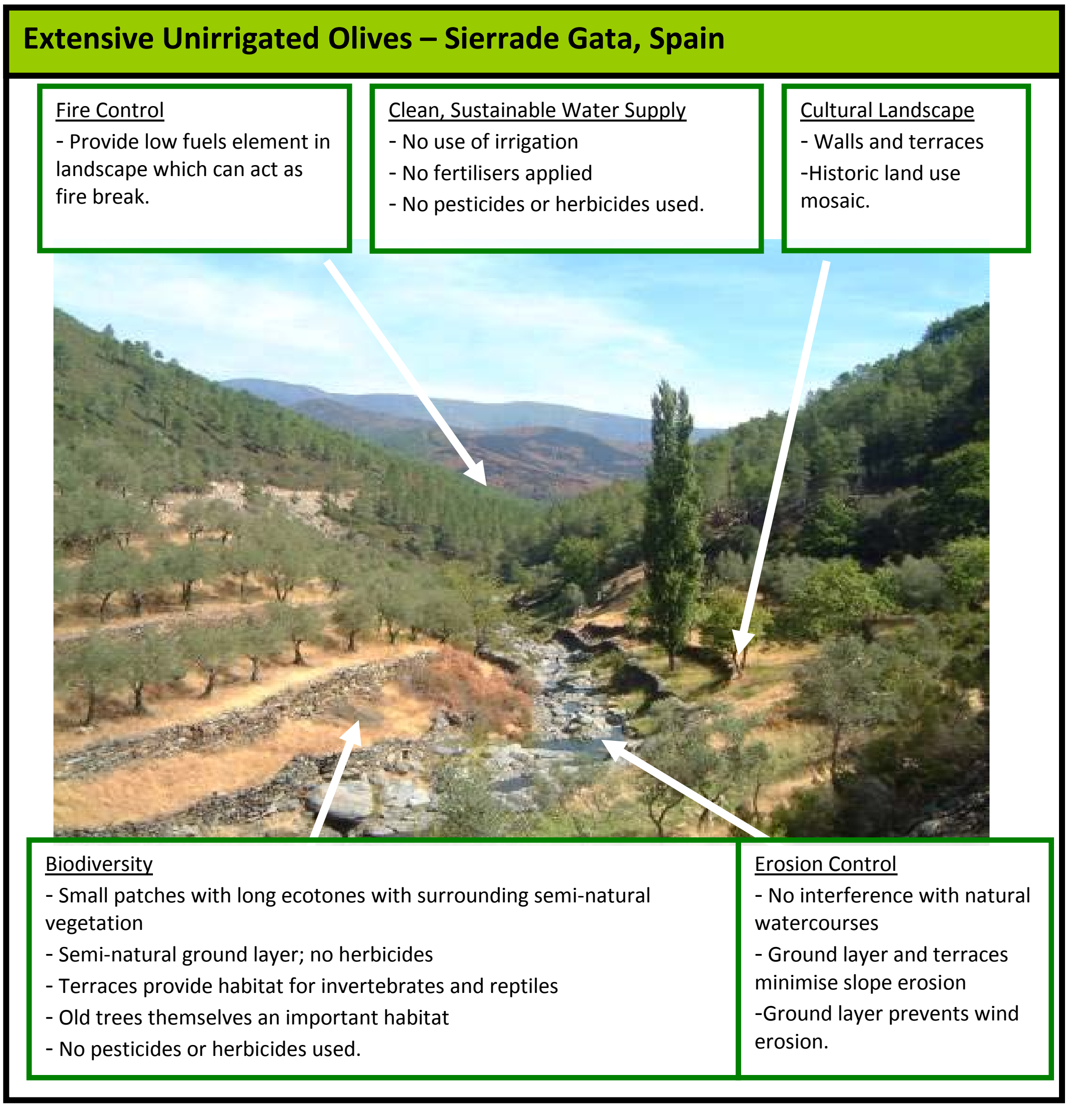


Figure 3.7 Extensive unirrigated olive systems provide a range of public goods

Photograph: Guy Beaufoy.

3.7 Horticultural Systems

Horticultural systems cover the cultivation of fruit, vegetables, flowers and ornamental plants, either as field crops or under glass or plastic. Most crops are intensively managed, with irrigation, fertilisers, pesticides and herbicides widely used and an increasing use of temporary plastic covering to protect field crops. In northern Europe, some crops may be grown in controlled climatic conditions with artificial heating and lighting and energy consumption can be significant (PBL, 2005; Defra, 2007). The fruit and vegetable sector is particularly well developed in Spain, Italy, Greece, Portugal, Malta and Cyprus. It is also important in Belgium and the Netherlands (where it is the primary non-livestock production sector) and in Poland, Hungary, Lithuania and the UK (Agra Informa, 2009).

Horticultural crops can provide colour and variety in the landscape. This is evident in the small scale patchwork of fields and crops in many corners of Europe, especially in the Mediterranean, often occupying hillsides and traditional terraces. The more open fields of large scale vegetable and soft fruit production are similar to arable landscapes but there are some special cases. The lavender fields of France provide a dramatic band of colour in the landscape of Provence while the highly intensively managed bulb growing areas in the west of Holland give rise to a landscape of bright contrasts which is unique in Europe. Generally speaking, however, horticulture is an intensive production system and most of the environmental public goods arise from the adoption of organic methods (Wyss and Pfiffner, 2006) and other lower input techniques such as biological pest control, reduced irrigation and careful soil management to reduce erosion and contamination.

3.8 Rice Systems

Rice is grown on about 420,000 hectares of farmland in the EU, mainly in Italy and Spain, but also in Bulgaria, France, Greece, Hungary, Portugal and Romania (Agra Informa, 2009). Rice fields are permanently flooded during the cultivation period spanning from April to July, and during the application of fertilisers and herbicides, using water from rivers or lakes, for example in the Po valley, Italy. Production techniques are predominantly intensive but give rise to a considerable area of artificial wetlands. In recent years, rice production has become concentrated on fewer, larger farms and become more mechanised.

Although it is a specialist crop, grown in a limited range of areas in the Mediterranean, rice production has a strong local influence on landscape and wetland values that marks it out from other crops. Rice is typically grown in shallow paddy fields that are flooded for several months of the year creating a string of artificial wetlands, some created previously from more natural wetland habitats. The landscape associated with rice production is highly characteristic, changing dynamically during the year from a geometric lake in spring time to bright green in early summer when the rice is growing in the water, yellow in early autumn and bare soil prior to planting in winter. There may also be established buildings associated with production, including those which up until the 1950s provided accommodation for workers. Examples of these structures can be found in the previously extensive production areas of Lombardy, Italy (Sereni, 1997). However, due to the mechanisation of the production procedure, these buildings are increasingly redundant and many have now fallen into a state of disrepair.

Given the limited area of remaining natural wetlands in the Mediterranean basin, rice paddies have acquired considerable environmental importance, including providing breeding grounds for waterfowl species, as well as providing distinctive cultural landscapes. They are biologically productive systems and factors such as vegetation structure, the presence of open spaces, water depth and macroinvertebrate biomass determine the abundance and variety of species that can benefit from rice production (Martinez-Vialta, 1996). Although considerable inputs of fertiliser are used in paddy fields, they can act as biological filters, retaining both organic and inorganic matter and in certain locations absorbing some of the pollution in input waters (Mazzini *et al.,* 1995). Since they are regularly flooded, rice paddies can contribute to a reduction in soil salinity and form part of a link between fresh water and marine ecosystems. Pollution from artificial nutrients and agrochemicals may occur and appropriate means of regulating inputs, including organic conversion, is one way of improving the state of environmental public goods associated with rice production.

3.9 Legumes, Pulses and Field Vegetables

Grain legumes include protein crops for animal feed (peas, faba beans and lupins), and other crops more often used for human consumption (chickpeas, lentils and vetches). These crops account for only 1 to 7 per cent of the arable crop area in most Member States, with peas being the main crop. Faba bean is cultivated all over Europe but other grain legumes are more specific to some regions: vetches and chickpeas in Spain; soya beans in Italy, France, Austria and Hungary; and lupins in Germany. These crops are grown as part of a (usually intensive) arable rotation, and although both yields and production costs are significantly lower than those of cereals, the improved fertility for following crops is an agronomic benefit. Legumes have nitrogen fixing bacteria associated with their root systems, improving soil fertility and also reducing the need for inorganic nitrogen in the crop rotation in which they are grown.

These crops add variety and agronomic benefits to the rotation but are grown on a limited scale as they generally produce a lower gross margin per hectare than cereals (von Richthofen *et al.,* 2006). They can be part of a more balanced and less extractive rotation, particularly in the case of legumes, with their nitrogen fixing properties reducing the requirement for inorganic fertilisers, leading to benefits for water quality, biodiversity and greenhouse gas emissions. They may provide winter soil cover in some cases, with benefits for soil conservation as well as reduced nutrient leaching.

3.10 Organic and Other Holistic Farming Systems

Some systems can be distinguished because of their approach to production rather than the main form of output. The best known and most widespread in Europe is organic farming – also known as "ecological" or "biological" production in some countries. This builds on a particular set of rules based on an approach which emphasises the recycling of resources and is sympathetic to many environmental objectives. There are variations on the organic theme, for example, biodynamic farming, but they share much in common and codified rules have been established at an EU level, setting a minimum standard for producers to meet if they wish to be recognised as organic. This is not true of any other specialist system in Europe and it is the only one considered here. Nonetheless, there are other "systems", generally defined less precisely, that do emphasise aspects of environmental management in the methods used. "Integrated agriculture", associated with reductions in usage of nutrients and agrochemicals and "conservation agriculture", concerned with reduced or zero tillage and improved soil management are both examples relevant to the provision of public goods.

Box 3.3 The contribution of organic farming systems to the provision of public goods

The practice of organic farming is often associated with enhanced environmental benefits when compared to conventionally managed systems. These are attributed to several key features intrinsic (although not exclusive) to the organic farming system (Hole *et al.,* 2005):

1. Reduction in the use of manufactured pesticides and prohibition of inorganic fertilisers;
2. Sympathetic management of non-cropped habitats; and
3. Emphasis on crop rotation and mixed farming.

The absence of inorganic fertiliser and pesticide inputs and the associated emphasis on crop rotation and soil management has an impact on the provision of a range of public goods. Yields and the intensity of production are nearly always lower than in conventional systems although there are some very intensive organic horticultural units. Water and soil pollution associated with manufactured pesticides is absent and there are benefits for biodiversity. Nutrient pollution of water may still occur because of the use of livestock manure but reduced nutrient fluxes and the specific risks of water pollution arising from inorganic fertiliser use are also avoided. Nitrate leaching can be lower than on conventional farms (Gosling and Shepherd, 2005).

The constraints on production provide organic producers with an agronomic motivation to maintain mixed rather than specialised forms of production, often combining livestock with arable crops, although there has been an increase in specialist forms of production in recent years. This has implications for the maintenance of landscapes as well as for biodiversity. Irrigation is less likely to occur than on specialised intensive farms although data confirming this have not been obtained. In principle, soil management is seen as a priority in an organic system and the frequent application of farmyard manure and regular inclusion of grass leys in arable rotations are characteristic of organic farms (Brown *et al.,* 2000).

In terms of biodiversity, organic management practices are thought to be beneficial for a wide range of taxa, including plants, mammals, birds and invertebrates (Hole *et al.,* 2005). A meta-analysis of pre 2002 literature by Bengtsson *et al.,* (2005) reveals that organic farms support on average, a 30 per cent higher species richness, with a 50 per cent mean increase in species abundance. As an example, the larger populations of anthropod groups seen on organic farms (Kleijn *et al.,* 2006) not only benefit bird species but also other species such as bats which thrive on the increased prey available on organic farms (Wickramasinghe *et al.,* 2003). Such increases in biodiversity have been attributed to a higher structural diversity and the propagating effects created by it.

The integration of biodiversity at the farm level is generally more likely to be achieved in organic rather than conventional farms (Caporali *et al.,* 2003), but the benefits of organic practices are subject to key variables including the species involved, and the landscape within which the farm is set. For example, the positive effects of organic farming on butterfly species richness and abundance are significant, but more pronounced in homogenous rather than heterogeneous landscapes and this appears true of a number of other species (Bengtsson *et al.,* 2005; Rundlöf and Smith, 2006; Gabriel *et al*., 2006; Pfiffner and Wyss, 2008).

There are several studies pointing to lower energy use on organic farms (Dalgaard *et al.,* 2001) but this is associated with lower yields per hectare. Energy use per unit of production may not be dissimilar to that on conventional farms. Emissions of greenhouse gases per hectare of farmland tend to be lower than on conventional farms but can be higher per unit of output, for example, per kilogramme of meat produced because of the lower yield, as illustrated for two mixed farms in Germany (Flessa *et al.,* 2002). The precise outcome will depend on the mixture of practices used. There are savings from the absence of inorganic nitrogen fertiliser, which is energy intensive to produce, whilst practices such as mechanical weed control and manure handling can increase the consumption of diesel and greenhouse gas emissions.

3.11 Identifying Beneficial Systems

The general patterns of provision of environmental public goods emerging from this overview of systems corresponds broadly with the picture emerging from the review exercise undertaken by ten European experts and reported in Annex II. This included a process in which the 13 selected agricultural systems were assessed in relation to the ten categories of environmental public good described in Chapter 2. The analysis suggests that a larger number of farming practices associated with extensive farming systems provide a range of environmental public goods – significantly more than intensive farming systems. Within each farming system, the level of public good provision varies, but a mixture of farming systems, including grazing livestock, is required to maintain the spectrum of public goods considered at the European scale.

3.12 Agricultural Structures

Alongside systems and practices, structural dynamics also influence the degree to which public goods are provided at a range of scales - parcel, holding and landscape. Whereas some systems are associated with a certain scale of management, such as the relatively large specialist cereal farms with typically large fields, a variation can be found in most farming systems, influenced by historic tenure and socio-economic conditions in different parts of Europe. Agricultural infrastructure, for example, patterns of drainage, irrigation and farm roads are also important in influencing the provision of a range of public goods and can constrain the management choices of an individual farm to a considerable degree. The literature suggests that there is no simple relationship between agricultural structures and public good provision but some patterns emerge.

Small field size can be beneficial because of the retention of natural or historic features, the contribution to a mosaic of land uses, the greater density of semi-natural vegetation likely to be present, and the constraints imposed on the use of larger and heavier machinery etc. Field boundaries and margins contribute a disproportionately larger share of most public goods relative to the area of land that they occupy, so a higher density of boundaries and margins will often be associated with a greater than average provision of environmental benefits. This is not always the case, however, and large expanses of appropriately managed unenclosed land are the preferred habitat for some species and a characteristic landscape in some countries.

The scale of the holding will have various implications, such as the ability to use certain technologies, the availability of labour, and the pressure to maximise returns per hectare. These will create a mix of positive and negative forces on the practices adopted and the environmental outcomes. Smaller farms have a number of attributes which may, in principle, result in their adopting less intensive management techniques. One is the more limited economies of scale to be achieved, reducing the returns from significant infrastructure works, or investment in sizeable machinery. Another is the limited access to capital in many small farms and the disproportionate representation of more traditional part-time and organic producers. Even if intensity of production on the holding is no lower than average, a landscape populated by small farms is likely to offer a greater variety in the crops grown, management systems and features, because of the larger number of decision takers and their varying perspectives, situations and abilities.

For example, in the Romanian valley that is illustrated in Figure 3.5, there are 300 or so farms resulting in a mosaic of small fields, each with their own management system and date for haymaking. The social choices that drive these decisions are visible in the landscape in a way that does not occur when only a handful of landowners control a valley. On the other hand, depending on their other commitments and sources of income and capital, farmers with larger holdings may have more time and resources to devote either to increasing economic returns and production levels or to adopting practices that are more sensitive to the environment. This may include leaving patches uncultivated, distributing livestock over a larger area, employing labour to help with environmental management, investing in more technically advanced equipment, seeking advice from professionals and providing for a larger scale of habitat where this is needed. They may also be more viable in the longer term (Potter and Lobley, 1993).

The literature confirms that the relationship between structure and environmental outcome is complex and influenced by many factors, including the history of land tenure. In Denmark, for example, a study based on agricultural registers and aerial photo interpretation indicated that there were significantly smaller fields and high densities of uncultivated landscape elements on smaller farms, defined as less than 25 hectares (Levin, 2006). A recent study of hay meadows in the Italian Alps on farms of different sizes, indicated that larger farms were associated with higher soil fertility and organic fertiliser use and generally managed flatter meadows. The biodiversity value was greater on the smaller farms since they were less intensively managed, but in occupying steeper land with poorer returns, they were more likely to abandon production (Marinia *et al.,* 2009). On the other hand, there is evidence to suggest that farms in former Western Germany with larger farm and plot sizes had higher levels of biodiversity than their counterparts in the former German Democratic Republic (Voigtländer *et al.,* 2001). A similar relationship has been found in England and Belgium, with evidence suggesting that larger farms may be more willing to enrol in voluntary agri-environment schemes, especially with regards to the adoption of buffer strips and unsprayed field margins. Smaller farms, however, may be reluctant to reduce intensity because of their more limited production base (Vanslembrouck *et al.,* 2005).

The nature of the agricultural infrastructure is also significant for the provision of many public goods, especially biodiversity, water and soil management and landscape. Deeper drainage and large scale irrigation, for example, are generally antipathetic to the provision of environmental public goods. Land consolidation involving the creation of larger, more agronomically viable parcels has resulted in major landscape changes in several Member States, often involving the removal of older field boundaries, trees and patches of unused land. All infrastructure works can be managed with varying degrees of sensitivity to the environment, and relatively simple management decisions, such as the way in which vegetation and silt is cleaned out from ditches. The extent to which streams are canalised can have a significant impact on the environmental profile of neighbouring fields as well as on the structures themselves.

The trend in Europe is towards larger farms and larger parcel size, with an accompanying tendency for holdings to become more specialised, partly to capture economies of scale. These structural changes will have a range of environmental impacts, with a tendency for “unproductive” landscape features to be removed, particularly along field boundaries. This simplification of the landscape was noted in several of the case studies. Examples included the removal of field islets and covering up of ditches in Malardalen, Sweden, of hedges and woodland edges in Schorfheide-Chorin, Germany, of hedges in land consolidation projects in Spain and in field trees and hedges in France (Farmer *et al.,* 2008).

The evidence on the impact of increasing farm and operational scale appears clearer than that on the relationship between farm size and the provision of environmental public goods. In a review of the issues in the early 1990s, Potter and Lobley argued that there was little evidence of a “functional” relationship between the economic or physical size of a farm and its environmental sensitivity, whilst noting that considerable environmental assets were found on small farms. At the same time they offer some support for the idea that the loss and amalgamation of small farms in some locations may trigger environmentally damaging land use, landscape and ecological change (Potter and Lobley, 1993). The more recent evidence considered here supports this second conclusion.

3.13 Threats to the Provision of Public Goods

There is evidence to suggest that the provision of a large segment of the public goods discussed here is under threat, with these declines resulting from two main trends in agricultural land management, notably increasing specialisation and intensification at one end of the spectrum, and marginalisation at the other.

The term “intensification” covers a range of structural and management changes all aimed at increasing the productivity of the land and the farmed unit. Different farmers will intensify production in different ways leading to important differences between regions and farm types. A comparison of FADN data between 1995 and 2006 showed that it is the largest farms (those over 100 ESU per farm) that have increased in size, with arable farms increasing the most, followed by dairy and mixed farms, with only small increases seen within grazing livestock farms. By contrast the medium sized farms (between 8 and 40 ESU/farm) decreased in size the most rapidly.

Some of the strongest intensification trends are found in the less-intensively farmed regions, which may have a negative impact on extensive farming systems and High Nature Value farmland. A decisive factor for species rich grasslands, for example, can be increased levels of fertiliser use. Farmers in the EU-12 Member States, who were unable to afford fertilisers and pesticides on any scale before accession to the EU, may increase usage of these inputs as they become more affordable in the context of full participation in the CAP. Considerable increases are projected for mineral fertiliser consumption in the new Member States over the 20 years from 2005; the use of nitrogen mineral fertilisers is expected to increase by about 35 per cent, while phosphate and potassium use increases of about 52 per cent and 41 per cent respectively[5] are

[5] In this case, 8 of the EU-12 Member States – BU, CY, MT and RO were not included.

foreseen (EEA, 2005c). If the price of arable crops, particularly cereals and oilseeds, rises in future, as many expect, this could trigger further conversion of grass to arable land, particularly on better quality soils, but some HNV grasslands on more marginal land could be at risk of conversion to biofuel crops, such as short rotation coppice.

On grazing livestock farms there are trends towards increases in scale, the abandonment of patches of less productive grazing, declining management of hedges, walls and other features and simultaneous intensification, including the conversion of hay to silage making and the use of maize as a fodder crop (Pain and Dunn, 1995). Most dairy farms are now intensively managed, a growing proportion of dairy cows are kept indoors and "zero grazing" is becoming more popular (Alliance Environnement, 2008), leading to a decline in landscape character.

The most immediate threats to extensive farming systems include reductions in management, outright abandonment, intensification, loss of small scale landscape features, or conversion to other land uses such as forestry, all of which are likely to result in the loss of some landscape character and biodiversity. In Spain, a study comparing traditional agro-grazing systems with modern and intensive agriculture in pseudo-steppes found that agricultural intensification and marginal land abandonment with subsequent scrubland invasion both have detrimental consequences for the Lesser Kestrel (*Falco naumanni*), a globally vulnerable Natura 2000 species (Tella *et al.,* 1998). Small scale, traditional HNV mixed farming systems within the EU are under pressure from many directions - poor market prices for livestock, the burden of food safety and animal welfare requirements, the economic attraction of reducing management effort while continuing to receive decoupled support (with no requirement to farm the land), and opportunities to sell land to larger farms (IEEP and Veen, 2005).

Marginalisation, and eventual land abandonment leads to a decline in grassland and arable habitats and an increase in scrub and forest in the landscape. Whether these changes are beneficial or detrimental to farmland biodiversity largely depends on their context and local conservation priorities. In predominantly open landscapes, small-scale abandonment can lead to increases in habitat and species diversity that can be beneficial, although the species that may benefit are often generalist species of low biodiversity value. Large scale abandonment, however, can lead to declines in habitat heterogeneity and species diversity across the landscape. This is particularly detrimental where it affects habitats of High Nature Value, as many species of high conservation value depend on such semi-natural habitats and may be of higher conservation importance than most of the generalist species that are likely to benefit from scrub and young forest habitats (MacDonald *et al.,* 2000; Laiolo *et al.,* 2004). All land abandonment will impact upon the character of the agricultural landscape and whether or not this change is viewed as positive or negative will depend on the geographic location, cultural heritage of the area and social preferences. In semi-arid areas, land abandonment may also lead to soil erosion where vegetative growth is slow and leaves land susceptible to erosion from wind and rain (Cerda, 1997; Pointereau *et al.,* 2008).

3.14 Conclusions

The provision of environmental public goods in European agriculture is widespread but clustered around a number of farming systems and the practices employed within them. One element of ensuring the provision of these public goods can be considered conservationist, requiring the continued management of historically established landscapes and biotopes which have acquired particular value and are difficult to substitute. A second element is more dynamic, including the development and use of new methods of saving energy and reducing greenhouse gas emissions from agriculture.

The evidence reviewed here suggests that public good provision is most often associated with:

- Certain systems of agriculture, particularly those that are extensive, where there is a coherent structure of linked practices which contribute to public goods provision in a holistic way. These are particularly important for the provision of biodiversity and landscapes;
- A valued suite of individual practices that may be deployed in a range of different production systems, including more intensive systems - some of these practices involve reductions in the use of inputs or the removal of land from production, as in the case of buffer strips; and
- A strand of specific practices and systems which are associated with energy efficiency and reductions in greenhouse gas emissions - including practices associated with intensive livestock production.

The extensive systems are of particular importance because of the range of environmental public goods that they contribute to, the relatively large area of land involved, and the importance of management continuity for maintaining many of the habitats, species and valued landscapes that have developed in conjunction with, and now depend on, these systems. Those of most importance are:

- The more extensive livestock and mixed systems;
- The more traditional permanent crop systems; and
- Organic systems.

Beneficial forms of agricultural management can be defined more precisely at the national and local scale where specific concerns, structural and locational factors can be taken into account more readily than at the EU scale. Nonetheless, it is clear that it is possible to target efforts to increase public good provision not only at individual farms and suites of practices, as frequently occurs in agri-environment schemes, but also at certain farming systems which are built on practices that have a less intensive impact on the natural environment.

The outlook for public good provision is a matter of concern because of underlying trends in agricultural restructuring, particularly with respect to specialisation and more intensive production in some areas, coupled with marginalisation and the loss of traditional practices in others.

4 THE CASE FOR PUBLIC SUPPORT

4.1 Introduction

Elaborating the theoretical arguments presented in Chapter 1, this chapter begins by examining where there is a case for public intervention to encourage the provision of environmental public goods through agriculture in the EU. In order to do this, empirical evidence is required on the current level of provision of public goods, compared to the scale of public demand, to demonstrate where undersupply occurs. After rehearsing the theoretical arguments, the first section of this chapter draws on a range of sources of evidence to provide an EU-wide overview comparing the scale of public demand to the current provision of public goods. The section concludes that there is evidence of undersupply with respect to all environmental public goods, and presents a suite of synthetic challenges that would need to be addressed to rectify this.

Public intervention can take a number of forms, including regulation, standards of good agricultural practice, advice and public support measures. The focus of this study, however, is where a case exists for the use of public support measures specifically. The second section of this chapter, therefore, identifies where farmers require a financial incentive to encourage the reallocation of their factors of production and other resources to underpin enhanced levels of environmental delivery, as codified in the reference level – a concept introduced in Chapter 1.

Determining what constitutes a desirable level of provision of public goods, however, is a difficult question. These are political decisions – with the state acting on behalf of society to articulate common and collective objectives – but, as with all political decisions, they are taken within the constraints of a budgetary framework and in relation to other public priorities, such as health and education. Section three of the chapter begins with a discussion on the setting of political targets to express a desired level of public good provision, and provides an overview of these targets at both the EU and national scale. It proceeds to examine where the reference level is currently set – in other words, what is the existing mandatory baseline with respect to the public goods that form the focus of this study. This is expressed in legislation and mandatory standards of Good Agricultural and Environmental Condition (GAEC), both at the EU level and within individual Member States. By comparing the target level and the reference level for each public good, it demonstrates where public support is needed to remunerate those actions that improve environmental delivery beyond those specified in the mandatory baseline.

4.2 The Case for Intervention

As demonstrated in Chapter 1, the provision of public goods with a high degree of publicness cannot be secured through the market. This is because a market cannot function as an allocation mechanism between suppliers and consumers in those cases where consumers cannot be excluded from consuming the good, often leading to resource over-exploitation. On the supply side, farmers have little incentive to provide public goods because they are not being paid to do so. In combination, these two factors explain the undersupply of public goods. In order to prevent, for example, ongoing declines in farmland biodiversity, the deterioration of landscape character, the degradation of soils and water, public intervention is needed. Without public intervention, society risks losing these valued public goods, and sometimes these losses are irreversible.

There is, however, no *prima facie* reason to intervene to secure the supply of all of the public goods provided through agriculture. This would be prohibitively expensive, and public finance is limited. Public intervention is only needed in those cases where public demand is greater than the current or prospective level of provision. Indeed, certain public goods are provided incidentally alongside the agricultural commodity, and therefore a deliberate allocation of resources is not required to ensure their ongoing provision, so long as the production activity continues to be economically viable. In other words, the case for public intervention can be made only when in its absence, the supply of the public good is inadequate or expected to decline.

Before examining the evidence on the degree to which the current provision of public goods satisfies the scale of societal demand, the main factors that influence the supply of and demand for the public goods provided through agriculture are discussed below.

4.3 The Relationship between Supply and Demand

The supply of public goods is not static, it changes over time. A range of factors influence agricultural production and land management in the EU, and hence the associated provision of public goods. These include market forces, macro-economic conditions, policy drivers, technological change and increasingly, the impacts of climate change. In the absence of policy intervention and a direct incentive to farmers to provide public goods, these drivers of agricultural restructuring often lead to a loss of beneficial land management with implications for the provision of public goods.

The scale of public demand for environmental public goods also changes over time. As widely discussed in the academic literature, there is a range of interlinking economic, political, social, cultural and institutional factors that influence social preferences for the environment. These social preferences vary between individuals, as well as reflecting value systems embedded in national and regional cultures. As such, the scale of public demand relative to the provision of public goods is a dynamic relationship, as well as being geographically and culturally specific. The principal factors influencing the scale of demand and provision of public goods are depicted schematically in Figure 4.1 below.

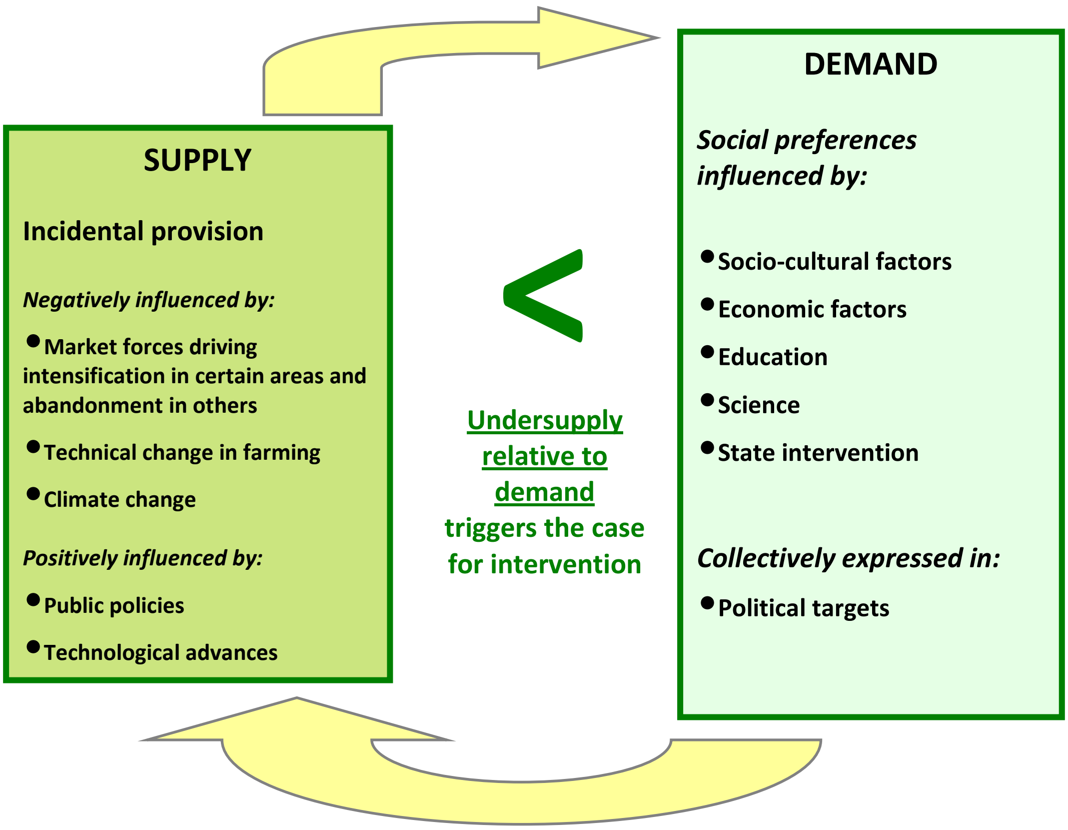


Figure 4.1 Factors influencing the supply of and demand for environmental public goods

4.4 Evidence for the Scale of Demand for Environmental Public Goods

Assessing the scale of demand in Europe for the public goods provided through agriculture is difficult. This is due to the fact that the very characteristics of public goods – their non-rivalry and non-excludability – means that there are no markets for these goods, and therefore there is no formal mechanism outside the political process through which consumers as 'citizens' can express their demand for a given public good. Individual preferences or attitudes towards the environment provide an indication of the existence of demand – as captured through behavioural indicators, such as visitor numbers to national parks, membership of environmental organisations, in attitudinal surveys and through contingent valuation studies. There are, however, inherent difficulties in aggregating these individual preferences into an articulation of the scale of demand for the 'common' public good, and as such, the evidence presented from these sources provides only a starting point for the analysis. In section 4.5 below, we proceed to a discussion on the role of the State in setting common environmental objectives, and therefore in capturing the level of demand of current and future generations, as well as that of non-users for the range of public goods that form the focus of the study.

4.4.1 Attitudes Towards the Environment

Attitudinal surveys point to widespread concern amongst the European public for environmental issues, as well as the high value that is placed on the environment, which is backed up in the academic literature. The most recent and comprehensive of these is the Eurobarometer State of the Environment Survey conducted in 2009 (DG Communication, 2009a), which surveyed the attitudes of a sample of respondents in all 27 EU Member States, with responses aggregated at the EU-27 scale (see Annex III, for a detailed overview of these results). Whilst low proportions of the sample identify the environment as being the most important issue facing their country (4 per cent), compared to the economic situation (47 per cent), or unemployment (45 per cent), a large proportion (64 per cent) indicate that protecting the environment is very important to them personally, with this figure rising to 79 and 89 per cent in countries such as France and Sweden, respectively.

There is a wide variation across Europe as to what is considered to be the most significant environmental issues. Respondents were asked what came to mind first when they thought of the environment, with 22 and 19 per cent of respondents citing pollution in towns and cities, and climate change, respectively. Only 13 and 12 per cent of respondents cited green and pleasant landscape and protecting nature, respectively. This is reflected in what they are most concerned about, with 57 per cent of all respondents at an EU scale worried about climate change, closely followed by water and air pollution (42 and 40 per cent, respectively). A much smaller proportion of respondents expressed concern about the depletion of natural resources (26 per cent), the loss of biodiversity (23 per cent) and agricultural pollution (23 per cent), indicating that concern at an EU level for the public goods associated with agriculture is perhaps lower compared to some other environmental issues. Public support for environmental protection is high across Europe - 82 per cent of respondents agree that European environmental legislation is necessary for protecting the environment, whilst 78 per cent agree that the EU should allocate more money to the protection of the environment, with this proportion as high as 89 per cent in Sweden, for example.

Certain social preferences are capricious, and are subject to change over time, whereas others are more deep-rooted. Climate change features highly in public priorities, particularly in the EU-15 Member States, but this is a recent development, perhaps prompted by the profile of climate change in the media, the growing and incontrovertible scientific evidence base, widespread campaigning on the part of NGOs, and the level of political debate and activity. Economic development is another important factor that influences the scale of demand for the environment. As societies become more prosperous and basic requirements for food, housing, education and health are satisfied, more disposable income is often available for recreational pursuits and enjoyment of the countryside, in turn increasing direct exposure to the natural environment and raising awareness of environmental degradation. Science also has an important role to play in raising the profile of environmental issues and can be a significant driving force in environmental policy-making (Benedick, 2005), by providing insights into the complexities and interactions of natural systems, establishing causalities between anthropogenic activities and environmental impacts, as well as providing the evidence base needed to inform the setting of targets in line with environmental sustainability and the development of appropriate indicators to measure the impacts of human activities.

Access to information also shapes social preferences and values. According to the recent Eurobarometer survey (DG Communication, 2009a), 55 per cent of respondents felt they were informed (very or fairly) about environmental issues, although this figure was much higher in countries such as the UK and Sweden (70 per cent), compared to in Italy, the Czech Republic and Romania (42, 40 and 30 per cent, respectively). Civil society has an important role to play in raising environmental awareness (Gazzard, 1977) - not least because in some Member States, the largest voluntary, subscription-paying organisations in civil society are environmental NGOs and public trust in environmental NGOs is high (Fowler 2000) - with many environmental NGOs running high profile campaigns to draw attention to environmental issues such as biodiversity loss, landscape degradation and climate change.

As well as these present day influences on social preferences, there are often long-established cultural factors that translate into a widespread demand for certain public goods in a particular society. The box below provides an indication of the scale of demand in the UK for landscape and biodiversity where there is a history of strong voluntary associations active in this area, stemming from a long-standing amateur naturalist tradition, and the high value placed on rights of access to the countryside (Evans, 1997).

Box 4.1 Evidence of widespread demand for landscape and biodiversity in the UK

The nature conservation movement in the UK is over one hundred years old and has a combined membership of over 5 million. The National Trust 'for places of historic interest or natural beauty' is the world's largest conservation society, with just over 3.5 million members, equivalent to 5.6 per cent of the total population, and owns 240,000 hectares of land. The Ramblers Association has 135,000 members, with their members and society at large enjoying access to thousands of kilometres of public pathways. Visitor numbers to National Parks also provide an indication of the scale of public demand for landscapes – many of which are agricultural, these received 45.6 million visitors a year in 2006, equivalent to 104 million visitor days, and with an annual visitor spend of £2,220 million. The number of visits to Areas of Outstanding Natural Beauty (AONB) is also high, with 3 million visits recorded in England in 2002.

The Royal Society for the Protection of Birds (RSPB), has a membership in excess of 1 million members, equivalent to 1.71 per cent of the UK population, and is bigger than the combined membership of all UK political parties. The UK Wildlife Trusts have a membership of just over 0.75 million, and over a quarter of a million volunteers spend in excess of 1.6 million days on practical conservation tasks. Visitor numbers to National Nature Reserves were just under 18 million in the 2006 - 2007 period, annual visits to RSPB reserves exceeded 1.8 million visits in 2008, while the Wildlife Trust reserves received just over 4 million visitors in 2006 – 2007.

4.4.2 Expression of Individual Preferences

A growing number of academics have explored the application of contingent valuation methodologies to reveal social preferences with regard to environmental goods and services (see, for example, Mitchell and Carson, 1989; Barde and Pearce, 1991; Pearce, 1993; Hanley *et al.*, 1998). A common assumption has been that these individual preferences can be aggregated to give the overall preference of society – in other words, to provide an expression of societal demand. As presented in Annex IV and summarised in Box 4.2 below, studies using these methodologies have revealed a wide range of different values for environmental public goods as expressed in monetary terms. This is perhaps not surprising given that the values that individuals ascribe to the environment in the frame of these studies are hypothetical, individuals have been shown to be inconsistent in the way they value the environment, values have been shown to change as respondents become better informed and there is often the absence of a meaningful budgetary constraint (see Cummings *et al.*, 1986 and Hausman, 1993 for a critique of contingent valuation approaches). Protagonists of these approaches argue, however, that these preferences as expressed as a monetary value can be used to inform the political decision-making process, and that the optimal public decision is the one which maximises the total preference satisfaction of all individuals.

Box 4.2 Results of selected contingent valuation studies with respect to landscape and biodiversity

Hanley *et al* (2007) investigated respondents' willingness-to-pay (WTP) for landscape features and habitats. A Choice Experiment was used to estimate WTP for different landscape features in four Severely Disadvantaged Areas of England. WTP was highest for heather moorland conservation, broadleaved and mixed woodlands and cultural heritage features such as old stone barns. The study did not find a significant WTP for field boundaries. Values for given landscape features were shown to exhibit regional variations.

Loureiro and López (2000) investigated the preferences of tourists for the local cultural landscape in the Ribeira Sacra region of Galicia (Spain). 173 tourists were interviewed and asked to choose between two alternative types of cultural landscape, with a number of attributes such as: preservation of traditional customs, food products, and rural settlements; protection of the local environment; protection of the traditional agro-forestry landscape; and preservation of the historical-cultural heritage. The WTP for each attribute (Euro per day) was estimated as follows: History: 22.39, Tradition: 7.45, Environment: 32.47 and Agri-forestry landscape: 24.44. The study concludes that visitors value the attributes they experience (for example the wildlife, the landscape and historical sites) more than local traditional products (for example local wines and foods).

Bonnieux and Le Goffe (1997) used the Contingent Valuation (CV) method to value the public benefits associated with a government programme to restore the "bocage" landscape in Lower-Normandy in France which was under threat due to conversion to non-agricultural uses. The programme involved the planting, regeneration and management of new and existing hedgerows and replacing elm trees with other species such as ash, maple and wild cherry. 400 households were interviewed. The mean WTP for the programme was estimated to be 227-303 French Francs (FF) per household per year, with the total value of the public benefits provided estimated to be 43.46 million FF.

Drake (1992) used the CV method to assess values ascribed to Swedish agricultural landscape by asking respondents their WTP, via income tax, for preventing half of all agricultural land from being cultivated with spruce forest. The sample size was nearly 1100. A mean WTP of SEK 468 per person per year was estimated. The value per hectare of agricultural land was calculated to be approximately 975 SEK per hectare per year.

There are, however, flaws in these arguments (Sagoff, 1988; Jacobs, 1997). These methodologies are derived from a model of private choice in markets. In such techniques, individuals – acting separately – spend their own money (real or hypothetical) on goods which benefit them. The choices they make can be taken as a plausible representation of the value they place on the goods in question. Broadly speaking, therefore, it may be accepted that these techniques are appropriate for the valuation of private goods – goods which people consume individually and which provide essentially private benefits. However, the problem with using these techniques with respect to ascertaining societal demand for public goods is that public goods have very different characteristics from private goods.

A key difference is the frame of reference that people employ when making choices about public goods. Determining an appropriate level of demand for any given public good is not rooted in what the value of that good is to the individual - as this will vary according to a whole range of parameters - nor can it be derived from an aggregation of the values of multiple individuals. Public goods are in the common interest – they are non-excludable and non-rival – which means that, in principle, personal interest is relatively unimportant. In asking respondents to ascribe a value to a public good, these techniques require the individual to act on behalf of society as a whole and not as a consumer. There is considerable evidence to suggest that people do adopt a wider perspective when considering environmental public goods (Clark and Burgess, 1994), which is backed up by studies of opinion formation on other public issues and in voting behaviour (Sears and Funk, 1991). Not everyone, however, will approach environmental issues in this way, and it cannot be assumed that they do. Private self-interest, rather than the public good, is often well at the fore of many people's voting choices or expression of value, leading to a divergence between individual and collective objectives.

4.5 The Articulation of Demand through the Political Process

These evidence sources give an indication of individual social preferences for different environmental media. For the reasons discussed above, it is not possible to scale up these different sources of information to indicate society's collective demand for public goods. Decisions about the desirable level of provision of public goods should be made on the basis of some conception of the common good - which is logically separate from the aggregation of individual private benefits or preferences. The need for agreement on a collective articulation of demand with respect to the scale of public good provision desired by society as a whole (which takes into account the demands of non-users, as well as the desires of current and future generations) is therefore critical. For this, society must turn to the political decision-making process which embodies well-established value systems, along with appropriate ways of making judgements when values conflict. In practice, therefore, society's collective demands for public goods are represented in political targets which stipulate the level of provision required, with implications for the scale of public expenditure needed to meet these targets. We return to this discussion in the latter half of the chapter.

4.6 Evidence for the Current Provision of Environmental Public Goods

Given that it is difficult if not impossible to gauge aggregate societal demand for public goods by summing up the declared demand of individuals, the political administration has to take a judgement as to whether the level of provision of public goods is sufficient or too little. Information does not exist on the total stock of public goods, so the detection of broad changes in the direction of provision is critical. This section provides an assessment of the current level of provision of the suite of ten environmental public goods associated with agriculture that form the focus of this study. The evidence base comprises a number of sources. First, the analysis presented in Chapter 3 provides a qualitative indication of the relative scale of public good provision in relation to specific farming practices and farming systems. In addition, it indicates the distribution and spatial coverage of those farming systems which support the provision of public goods at a European scale, as well as providing a sense of the relative frequency of beneficial farming practices. This analysis therefore affords an indication of current levels of provision at a broad pan-European scale, providing a contextual framework for an analysis of state of the environment indicators. Providing data at the pan-European scale, these indicators provide a more detailed insight into the state of a range of environmental media associated with agriculture, with certain indicators providing trend data on changes in condition over time.

Indicators on the state of Europe's environment have been developed under a number of exercises, including, for example, the IRENA operation (EEA, 2005d), the SEBI 2010 process (EEA, 2009b) the OECD (OECD 2008), as well as through the Common Monitoring and Evaluation Framework (CMEF) which has introduced a number of indicators to assess the baseline situation with respect to a suite of environmental media at the start of the current rural development programming period (2007). The most relevant EU-wide indicators are presented in Table 4.1, which summarises their current status as well as trends over time where data exist, with a more detailed commentary provided in Annex III.

Using state of the environment indicators to assess the current level of provision of public goods associated with agriculture carries a number of limitations, however. First, many of these indicators only provide information at a pan-European scale. Trends that are relatively clear at the European level may mask considerable differences between Member States, and indicators are not sensitive enough to capture changes in environmental media at the farm level arising from individual management decisions. Second, given the multifaceted nature of certain of these public goods, such as agricultural landscapes, for example, indicators relating to a single parameter - such as land cover, or the presence and distribution of farmland features - are often an inadequate measure of the composite whole.

Furthermore, for many indicators, data have not been collected over time, which means that they only provide a snap-shot of the current level of provision, rendering it difficult to ascertain whether the environmental state is improving or declining. Within biological and hydrological systems there is often a considerable time lag between the causative farm management practices and the observed environmental impacts which, coupled with the absence of a meaningful counterfactual, means that indicators may not detect the impact of present day management practices. These issues notwithstanding, the suite of state of the environment indicators currently available afford a useful insight into the current provision of environmental public goods at a European scale, and data collection is improving all of the time.

Table 4.1 An overview of the status of a range of EU-wide state of the environment indicators relating to agriculture

Key

↑	Indicator shows upward trend
↓	Indicator shows downward trend
+	Suggests an improvement in the state of the environmental media
-	Suggests a decline in the state of the environmental media
=	Suggests no change in the state of the environmental media
?	Trend in indicator unclear

Indicator	Source	Status	State of the environmental media
Agricultural landscapes			
Cropping / livestock patterns	IRENA[1] 13 SDI[2]	↓	-
Land cover change	IRENA 24 CMEF[3] baseline indicator for context 7, EEA[4]	?	?
Intensification / extensification (EEA) Area under extensive agriculture	IRENA 15 CMEF baseline indicator for context 9	↑*	+
Landscape state (EEA) Ecosystem (habitat) diversity (OECD)	IRENA 32 OECD[5] agri-environmental indicator viii	?	?
Landscape	IRENA 35 OECD agri-environmental indicator x	↑↓	+/-
Farmland Features and habitats	Farmer *et al.*, 2008 (6 national surveys + case studies)	↑↓	+/-
Farmland biodiversity			
Farmland birds	Farmland bird population index[6] SEBI[7] 1a IRENA 28 CMEF Baseline indicator 17	↓ (=)	-
Grassland butterflies	Butterfly Conservation Europe, SEBI 1b	↓	-

Conservation status of Natura 2000 farmland habitats	SEBI IRENA 4 CMEF baseline indicator for context 10	↓	-
Livestock genetic diversity	SEBI 6 IRENA 25	=	=
Consumption of pesticides	IRENA 9	↑	-
Impact on habitats and biodiversity	IRENA 33	↓	-
Water quality			
Nitrate and pesticide contamination	IRENA 30.1 and 30.2 CMEF baseline indicator 21	=/?	=/?
Mineral fertiliser consumption	IRENA 8 FAOstat	↑↓	+/-
Share of agriculture in nitrate contamination	IRENA 34.2	?	?
Water availability			
Water use (intensity)	IRENA 10 CMEF Baseline indicator 15 OECD agri-environmental indicator iii	↑	-
Water abstraction (second level SDS indicator)	SDI IRENA 22 OECD agri-environmental indicator iii	↓	+
Share of agriculture in water use	IRENA 34.3	=	=
Soil functionality			
Farm management practices - tillage	IRENA 14.1 OECD agri-environmental indicator i	?	?
Farm management practices – soil cover	IRENA 14.2	?	?
Gross nitrogen balance (EEA) Nitrogen balance of agricultural land	IRENA 18 CMEF Baseline indicator 20	↓	-
Pesticide soil contamination	IRENA 20	↑?	- ?
Soil erosion (risk by water)	IRENA 23[8] CMEF Baseline indicator 22 OECD agri-environmental indicator i	↓↑	-/+
Soil quality (measure of soil organic carbon content)	IRENA 29	↓↑	-/+
Climate stability - carbon storage			
Soil organic carbon	CLIMSOIL[9] JRC[10]	?	?

Climate stability – greenhouse gas emissions			
Emissions of methane (CH4) and nitrous oxide (N2O) from agriculture	IRENA 19	↓	+
Share of agriculture in GHG emissions	IRENA 34.1 CMEF Baseline indicator 26 OECD agri-environmental indicator v	=	=
Air quality			
Emission trends for a number of air pollutants	EEA	↓	+
Ammonia emissions	IRENA 18sub	↓	+
Resilience to flooding			
Occurrence of flood events in Europe (indicator CLIM 17)	EEA[11] JRC[12]	↑	-
Resilience to Fire			
Forest area burnt	JRC	↓?	+ ?
Forest fire danger (indicator CLIM 35)	EEA	↑	-
Agricultural Land Use			
High Nature Value farmland	IRENA 26 CMEF baseline indicator 18	?	?
Marginalisation	IRENA 17	?↑	? -
Farmland abandonment	Pointereau *et al.* 2008	?	?
UAA under organic farming	SDI IRENA 7 CMEF Baseline indicator 23	↑	+

Notes:
*Relates to the trend in low-input farms
[1]IRENA indicators from European Environment Agency
[2]SDI - Sustainable Development Indicator, Eurostat (2007)
[3]CMEF Objective related Baseline Indicators, EAFRD
[4]EEA (2006a) Land accounts for Europe 1990 - 2000. EEA report no. 11/2006
[5]OECD agri-environmental indicators of regional importance and/or under development
[6]Common Birds Indicator from Pan-European Common Bird Monitoring Project of European Bird Census Council (EBCC) / RSPB / Birdlife International / Statistics Netherlands
[7]SEBI 2010 indicators, (EEA, 2009b)
[8]Using PESERA model (EEA 2005e)
[9]Schils *et al.* (2008) CLIMSOIL.
[10]http://eusoils.jrc.ec.europa.eu/ESDB_Archive/octop/octop_download.html
[11]http://themes.eea.europa.eu/IMS/ISpecs/ISpecification20080711160148/IAssessment1216632419101/view_content
[12]http://floods.jrc.ec.europa.eu/flood-risk

All of the 36 indicators identified as relevant for detecting assessing the state of a range of environmental media point to a situation of undersupply, although there have been improvements in air quality, regional improvements in soil quality, and a reduction in greenhouse gas emissions from agriculture. The situation is an unsatisfactory one and even where improvements have been made there is clearly scope for further progress.

Individual indicators point to a continuing decline in farmland birds - although over the last decade, the situation has stabilised at the EU level (SDI Report 2007 and DG AGRI RD Report, 2008), the poor conservation status of a majority of Natura 2000 sites, high rates of soil erosion by water and wind, a depletion in soil organic matter (EEA, 2007 and OECD, 2008), the poor 'ecological status' of many water bodies resulting from nitrate and phosphate contamination and unsustainable levels of water abstraction particularly in water stressed areas (EEA, 2009a), and a decline in landscape character threatened by a loss of landscape elements, simplification and reduced management.

Based on the available evidence, it is clear that certain environmental media and geographical areas emerge as policy priorities - specifically the Mediterranean area and the Iberian Peninsula with respect to the maintenance of High Nature Value (HNV) farmland, the prevention of soil erosion, improving water quality and encouraging sustainable water use. Maintaining HNV farmland in central and eastern Europe, together with Scotland and Western Ireland, is clearly another priority, but the paucity of data for the new Member States may simply be concealing other, equally urgent, policy issues in these 12 countries.

For a more detailed picture to emerge of the state and condition of environmental media arising from the impacts of agricultural management, further investments in data are required, including robust and consistent data from across all EU-27 Member States, collected at regular intervals, and with sufficient geographical coverage, specifically in relation to water and soil quality, carbon storage, and composite measures of landscape character.

Reporting requirements under the Nitrates Directive (91/676/EEC) and the Water Framework Directive (2000/60/EC) will improve information with respect to water quality. The introduction of six relevant CMEF baseline indicators along with five relevant contextual baseline indicators (see Table 4.1), means that more data will become available over the course of the current rural development programming period, particularly with respect to soil and water quality, as well as the share of agriculture in total greenhouse gas emissions. Finally, a set of 28 agri-environment indicators, selected on the basis of the outputs of the IRENA operation, are currently under development and data will cover the EU-27 Member States, as foreseen in a Commission Communication on the 'Development of agri-environmental indicators for monitoring the integration of environmental concerns into the CAP (COM(2006) 508). The data collected to feed this expanding suite of indicators will serve to improve the evaluation of policies targeted at the provision of public goods in the future.

4.7 Reversing the Undersupply of Public Goods

In the preceding sections (along with the accompanying annexes), evidence for the undersupply of environmental public goods relative to the scale of public demand has been presented. Before discussing where this implies the need for public support, the following section introduces ten challenges for policy which have been developed in light of the available evidence. If addressed, they would contribute to reversing this situation of undersupply.

Policy Challenge 1: To Maintain the Diversity and Distinctiveness of Agricultural Landscapes

Traditional agricultural landscapes across the EU are highly valued for their aesthetic character and cultural associations - often resulting from a significant degree of continuity in the pattern of the main landscape elements - which in turn contributes to a sense of place, regional identity and cultural heritage. The character of many agricultural landscapes is being degraded due to a concentration and specialisation in agricultural production, intensification in land use, coupled with the removal of landscape elements, and agricultural abandonment.

There is a need to safeguard the diversity of agricultural landscapes at a European scale, and to maintain their integrity and distinctive character at a landscape scale - in terms of the mix of land uses, the continuity and structural diversity of habitats and farming systems and the presence of livestock, and of mosaics at a more micro-scale through the maintenance and restoration of landscape elements.

Policy Challenge 2: To Maintain and Enhance the Ecological Integrity of Agricultural Areas

The ecological integrity of many agricultural areas in the EU is under threat as a result of intensification, landscape simplification and fragmentation, resulting in the loss of habitat mosaics with negative impacts on the feeding, breeding, dispersal and migratory needs of farmland species. In turn, this contributes to the loss of biodiversity and of associated ecosystem services such as pollination.

There is a need to support the maintenance and beneficial management of habitats within more intensively managed cropland – particularly semi-natural vegetation and grassland – in ways that promote species richness and biodiversity, **and to maintain and restore non-farmed landscape elements to maintain and enhance ecological integrity, resilience and functional connectivity at a landscape scale**.

Policy Challenge 3: To Conserve and Restore Farmland Biodiversity

In most of Europe, centuries of agricultural management has transformed the native, climax vegetation, resulting in significant changes in vegetation composition and structure. Many species have adapted to these changes and are now dependent on the continuation of predominantly traditional low intensity farming systems and associated management practices, some of which are analogues of former natural habitats that no longer exist in a European context (such as grassland steppes). However, these habitats - particularly those associated with High Nature Value farmland - and their associated species are under threat in much of Europe, primarily as a result of structural shifts in farming, investments and technological developments, resulting in either intensification or agricultural land abandonment (Baldock *et al*., 1993; Beaufoy *et al*., 1994; EEA, 2004).

As a result, declines in many farmland species - of both rare species and common species - have been recorded in recent decades, and these are particularly well documented with respect to farmland birds in Europe (Pain and Pienkowski, 1997; Tucker and Evans, 1997; Donald *et al*., 2001; Newton, 2004) showing that farmland bird populations are continuing to decline (EBCC/RSPB/BirdLife International/Statistics Netherlands (2008), cited in EEA (2009b).

There is a need to halt further losses and to restore farmland biodiversity through the **maintenance of High Nature Value farming systems**, the reduction of damaging practices **and the adoption of beneficial farming practices in more intensive agricultural landscapes**.

Policy Challenge 4: To Conserve Genetic Diversity

There are over 2300 different breeds of livestock in Europe today, more than anywhere else in the world. They, as well as local crop varieties, have evolved through centuries of local farming traditions and are therefore particularly well adapted to their environment. An important component of halting biodiversity loss is to preserve the genetic diversity of crops and domesticated species.

There is a need to conserve the EU's rare domestic breeds and crop varieties, to promote genetic diversity and to ensure the continuation of the characteristic grazing preferences of these livestock which in turn help to maintain the species diversity and structure of habitats of European importance. Local crops provide landscape and biological diversity and both crops and breeds form a gene pool which may be needed as European agriculture adapts to a changing climate and the new pests and diseases it is likely to bring.

Policy Challenge 5: To Achieve Good Ecological Status in All Water Bodies

High quality water is conducive to human and ecosystem health, and supports biodiversity.

Given that many of Europe's watercourses and groundwater bodies are adversely affected by point and diffuse pollution as a result of nutrients and sediment from agricultural run-off, **there is a need to achieve good ecological status of all water bodies.**

Policy Challenge 6: To Encourage Sustainable Water Use

Around 50 per cent of the EU population currently live in water stressed areas, largely due to the increasingly unsustainable exploitation of water resources by abstraction, particularly for agricultural use, for example, for the irrigation of high value crops in the Mediterranean region. This is being exacerbated by climate change.

There is a need to ensure the sustainable use of surface and groundwater supplies by matching the water abstraction rate to the replenishment rate of water from rivers and groundwater aquifers, **to ensure that the water saved is returned to the environment** and **to ensure the security of long-term supply for all users**.

Policy Challenge 7: To Improve the Functionality of Agricultural Soils
Well functioning soils deliver benefits for biodiversity, carbon sequestration and water infiltration and form the basis for food production. **There is a need to improve the functionality of all soils** to support sustainable food production, soil biodiversity and infiltration capacity, which will require improvements in the management of the many cultivated soils that are in a degraded state - suffering from erosion, compaction and reduced organic matter – often as a result of continuous arable cropping.

Policy Challenge 8: To Increase the Carbon Storage Capacity of Agricultural Soils
A significant volume of carbon is locked up in agricultural soils and semi-permanent vegetation. Carbon sequestration is recognised as an important strategy to mitigate rising concentrations of atmospheric CO_2, and to prevent further increases in global temperature. As part of a commitment to lowering the concentration of atmospheric $C0_2$, agriculture - as the dominant land-use in Europe and with a major impact on soil health/functionality - has an important role to play in preserving soil carbon stocks. **There is a need to manage agricultural soils and in particular, those with a high proportion of organic matter** (for example, peat and land under permanent pasture and semi-natural vegetation, including woodland) **to avoid losses of carbon, and to manage mineral soils with a low carbon content** (for example, as a result of continuous arable cropping) **to increase their carbon storage capacity**.

Policy Challenge 9: To Reduce GHG Emissions from Agriculture
The agriculture sector in the EU is responsible for 9 per cent of total GHG emissions, largely from methane and nitrous oxides. In line with a commitment under the Kyoto Protocol to reduce GHG emissions by 8 per cent across the EU by 2012 and to maintain temperatures within 2^0C of 1990 levels, **there is a need to reduce GHG emissions from agriculture** through a reduction in fossil fuels used for power and in mineral nitrogen fertilisers, as well as the emissions of methane (a highly potent GHG), in particular, associated with the livestock sector.

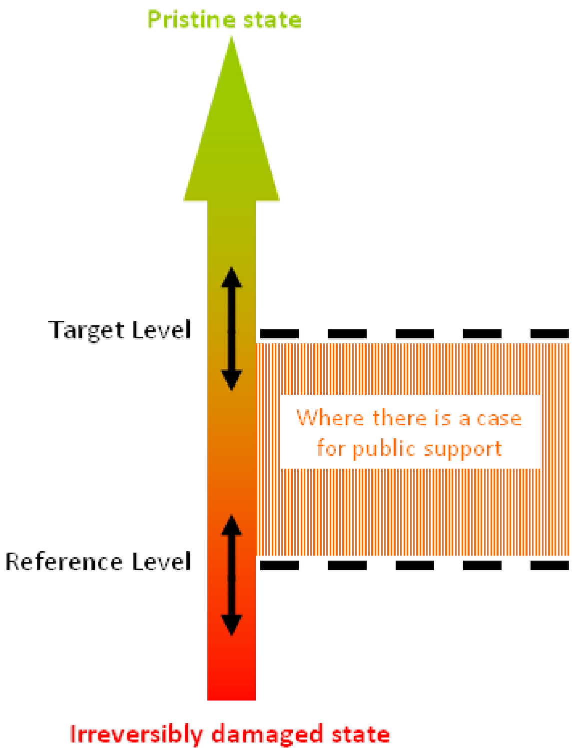
Policy Challenge 10: To Increase the Resilience of Agricultural Land to the Risks of Fire and Flood
With predicted changes in temperature and rainfall patterns, certain parts of the EU are likely to experience increased drought and an associated risk of fire, and other areas are likely to experience higher rainfall and risk of flooding. **There is a need to promote those forms of agricultural land management** – at the farm and landscape levels – **that are well adapted to changing weather patterns, and improve resilience to the risks of fire and flooding**.

4.8 The Case for Public Support

In order to secure the provision of public goods in line with society's demands and to reverse the undersupply detected in the evidence presented above, it has been established that some form of public intervention is required. Given the aim of this study, it is important to identify where this intervention needs to take the form of support to farmers to adopt beneficial management practices. Indeed, when a farmer holds the property rights as well as controlling the factors of production - and therefore can expect a factor income from them - society or the taxpayer has to purchase what amounts to a reallocation of resources towards the provision of public goods, where the necessary activities go beyond those specified in mandatory requirements.

As discussed in Chapter 1, a number of framing principles exist which help to distinguish between those actions which are compulsory for the land manager to undertake and for which he/she should bear the cost, and those actions for which the land manager should be remunerated. These principles are translated into the reference level, which takes into account the legal framework alongside the system of property rights, which stipulate what a farmer may or may not do with respect to a particular physical entity. Where additional actions are required beyond the mandatory baseline in order to achieve environmental outcomes in line with political targets, the State should introduce mechanisms to stimulate supply by remunerating farmers for a deliberate reallocation of their factors of production to meet specified environmental objectives. These ideas are illustrated in Figure 4.2 below.

Both the mandatory baseline and the environmental objectives specified in targets change over time (as depicted by the upward and downward facing black arrows in Figure 4.2), and differ between Member States. This means that those actions which warrant public support will differ between Member States, reflecting national political priorities, budgetary constraints, and legal frameworks. In the section that follows, relevant political targets as well as the requirements set out in the mandatory baseline are identified with respect to the ten key environmental public goods provided by agriculture.



Note: Public support is needed to encourage those actions that deliver environmental quality beyond those specified in the legislative baseline, up to the level of provision as stipulated in political targets. Neither the target level nor the reference level is fixed, they differ between Member States and can change over time.

Figure 4.2 Where there exists a case for public support

4.9 Setting Targets with Respect to the Provision of Public Goods

As discussed in Section 4.4, decisions about the desirable level of provision of public goods should be made on the basis of what is in the interest of society at large, taking into account the demands of non-users, as well as the desires of current and future generations. For a collective articulation of demand, society must turn to the political decision-making process and therefore, in practice, the desirable level of provision s expressed in political targets. These are derived in a number of ways. Certain of them have a strong scientific underpinning, informed by notions of scientific sustainability, all are determined through political debate, with decisions ultimately taken within the context of a budgetary framework, and in relation to a whole range of other public policy fields and priorities.

Increasingly, however, certain economists are arguing that because society is systematically underestimating the scale of environmental degradation and that this materially threatens well-being in the future, it is useful to have broad estimates of the value of individual or categories of environmental public goods.

In turn, these estimates provide a stimulus to mobilise the actions and budgetary resources necessary to induce the delivery of environmental improvements and thus to inform the setting of political targets (RISE, 2009). The few macro-level studies that have been undertaken to date indicate that the monetary value of environmental public goods and services may be very large, with similarly large welfare losses associated with their degradation (see, for example, Costanza *et al*., 1997; Stern, 2006; Braat and Ten Brink, 2008; TEEB, 2009).

A piece of work undertaken within the auspices of the TEEB study (The Economics of Ecosystem and Biodiversity) includes a set of calculations to determine the Costs of Policy Inaction (COPI) associated with not meeting the global 2010 biodiversity target (Braat and Ten Brink, 2008). The results indicate that the losses to global welfare from the loss of biodiversity from terrestrial ecosystems are in the order of €50 billion per year, or just under 1 per cent of global GDP, rising to €14 trillion or 7 per cent of estimated global GDP by 2050 if current rates of biodiversity loss continue to occur.

Whilst some are sceptical about the methodologies used to derive these estimates of monetary values, the resulting figures – which provide insights into the relative scale of social value which could be achieved – are useful to inform debates about whether to devote more resources to the environment in comparison to any other public service. Indeed, if marginal benefits exceed marginal costs, it suggests that more resources should be allocated to environmental delivery, with implications for the setting of appropriate political targets.

4.10 Overview of Existing Targets for Public Goods

All EU level targets relating to the ten environmental public goods that form the focus of this study may be found in Annex V, and are summarised in Figure 4.3 below. These targets apply to all Member States. In many cases, they are translated into targets at the national and/or regional levels, although the number of detailed targets varies between Member States, and depends on the public good in question. The number of relevant targets has increased over time, with targets in relation to greenhouse gas emissions, soil quality, water quality and availability, and resilience to flooding (through Council Directive 2007/60/EC on the assessment and management of flood risks), in particular, being added alongside more established targets relating to biodiversity, for example.

The nature of relevant targets - set at both the EU and national levels - is variable. They comprise both explicit and implicit targets, as well as legally binding targets and certain targets which are not legally enforceable. Explicit targets are often contained within international and EU level agreements and conventions, which are set out the EU's formal environmental commitments, and within certain pieces of EU and/or national legislation. Explicit EU targets exist predominantly in relation to biodiversity, water quality, greenhouse gas emissions and air quality, and typically prescribe clear and quantified goals, in certain cases to be met within a specified timeframe.

Examples include explicit targets in relation to biodiversity, as set out under the EU Sustainable Development Strategy (2006) to halt the loss of biodiversity by 2010; to water quality and availability under the Water Framework Directive (2000/60/EC) with a target of preventing any further deterioration and achieving good ecological condition in all water bodies by 2015; to greenhouse gases, where the EU has a target under the Kyoto Protocol for an eight per cent reduction in GHG emissions below 1990 levels by 2012; and to air quality, where the National Emissions Ceiling Directive (2001/81/EC) sets limits for each Member State for emissions of sulphur dioxide, nitrogen oxides, ammonia and volatile organic compounds by 2010. Of these explicit targets, for example, the EU SDS target for biodiversity is not legally binding on Member States, and as such is difficult to enforce through policy, whereas that under the Water Framework Directive (2000/60/EC) is enshrined in legislation and therefore non compliance by Member States could be dealt with through the European Court.

For certain public goods, such as valued agricultural landscapes, where no explicit targets exist at the EU level (although the European Landscape Convention which came into force on 1 March 2004 encourages 'the integration of landscape into all relevant areas of policy'), implicit targets are embedded within particular policies such as those found within the Community Strategic Guidelines for Rural Development (Council Decision 2006/144/E). These guidelines state that 'To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to Axis 2 should contribute to three EU level priority areas: biodiversity and the preservation and development of high nature value farming and forestry systems and traditional agricultural landscapes; water and climate change', with policy and measure specific targets set out in the CMEF results and impact indicators (see Annex VI).

4.11 Overview of Existing Legislative Requirements

As applied in an agricultural context, the reference level is either enshrined in legislation setting out legal requirements in relation to minimum standards which must be adhered to by law, or is expressed in standards of good agricultural practice which, although not enforceable in a legal sense, are practices that are expected of all farmers. The legislative baseline specifies those actions which are compulsory for the farmer to undertake and for which he/she should bear the cost. In most cases, EU legislation is in the form of Directives, which provide a broad framework for transposition into national law and implemented at Member State level. The EU and national legislative requirements that apply at the farm level and are of most relevance to the public goods that form the focus of this study are included in Annex VII. The main EU legislative requirements are summarised in Figure 4.3 below.

At the EU level, the restrictions imposed on farmers in relation to biodiversity and landscapes that are consistent across the EU relate to the requirements under the Birds Directive (79/409/EEC) and the Habitats Directive (92/43/EEC) to protect listed species of flora and fauna as well as their breeding sites and resting places. The requirements of the Birds and Habitats Directives place the onus on Member States to designate sites as Special Areas of Conservation (SACs) or Special Protected Areas (SPAs) to form a 'coherent ecological network'. Individual Member States may impose additional restrictions on farmers in terms of specific activities that are prohibited, or specific management that is required to be undertaken at the farmer's expense, either through the transposition of EU law into national legislation or through the introduction of additional national or regional legislation. Many of these national or regional legislative requirements are included within the mandatory GAEC standards under cross compliance.

Within the case study countries, additional legislation in relation to biodiversity and landscape is applied in Germany, Sweden and the UK. For example, in some German Länder, 'protected area regulations', which transpose the Birds and Habitats Directives into regional law, place additional requirements on farmers, for example, banning the ploughing of grassland, preventing changes to water levels, or imposing requirements to retain certain landscape features within Natura 2000 sites (Baden-Württemberg, Germany), which means that the costs of these requirements are borne by the farmer. In other Member States, these requirements are not part of the legislative baseline and most obligations are paid for through rural development measures (see Chapter 5).

Other examples relate to the protection of landscape features. In Sweden, the Regulation on the respect of natural and cultural values in agriculture (SJVFS 1999: 19) prevents the damage or removal of a range of landscape features, as well as restricting actions – such as spreading of organic and chemical inputs on arable and grassland – that may damage the natural or cultural values of the area. In England, the Hedgerow Regulations (1997) prohibit the removal of hedgerows of biodiversity, landscape and historic importance and Tree Preservation Orders (TPOs) protect particular trees of landscape importance, requiring consent before any work is carried out.

In addition and at an EU level, legislation exists to improve water quality through the Nitrates Directive (91/976/EEC) and the Water Framework Directive (2000/60/EC); to improve soil quality through restrictions on inputs to soils under the Groundwater Directive (80/68/EEC) and Sewage Sludge Directive (86/278/EEC) (which also impact on water quality); and to improve air quality through the minimisation of emissions under the Integrated Pollution Prevention and Control (IPPC) Directive (96/61/EC), although this only relates to intensive livestock (mainly intensive pig and poultry) units. In addition, the European Commission has adopted a proposal for a Soil Framework Directive (COM(2006) 232) to improve the protection and encourage the sustainable use of soil. There are no EU legislative requirements for carbon storage, sustainable water use, or with respect to greenhouse gas emissions from agriculture. In some cases, however, non-regulatory standards have been introduced under GAEC, for example, in relation to basic soil management practices, where these have been made a condition of receipt of payments and entry into incentive schemes.

Whilst there is a common regulatory framework at the EU level with respect to certain environmental media, there is a degree of variability in the legislative baseline across Member States. For example, there is a common standard for the use of organic nitrogen in Nitrate Vulnerable Zones (NVZs) under the Nitrates Directive, which is set at 170 kgN/ha[6], however, a number of Member States[7] have been granted derogations to apply higher rates of nitrogen. In addition, the way in which Member States have chosen to implement other requirements of the Nitrates Directive can vary from region to region as well as within and outside NVZs. For example, in France, farmers are required to introduce five metre wide buffer strips along rivers and watercourses within NVZs, and the nutrient plans that are required within NVZs have been included as a requirement for all farmers entering an agri-environment agreement, with the additional requirement that the use of both phosphorous and nitrogen is recorded.

The analysis of current EU environmental targets and the legislative baseline in relation to the ten environmental public goods is summarised in Figure 4.3 below. For each public good, it identifies the political targets, along with a summary of those actions that are required of farmers as stipulated through mandatory requirements. In doing so, it indicates where additional actions are needed in order to achieve the levels of public good provision as set out in political targets, and by implication, where public support measures are needed to stimulate supply. Building on the case for public support presented in this Chapter, as well as the analysis of the existing legislative baseline, Chapter 5 provides a catalogue of the current policy support measures that are in use to encourage the provision of public goods.

[6] 210 kg N/ha for new Member States following the first 4 years after accession.

[7] Belgium, Ireland, Germany, Denmark, Netherlands, United Kingdom.

Figure 4.3 Where public support is justified to meet environmental targets

	Agricultural Landscapes	Farmland Biodiversity	Water of High Quality	Water Availability	Soils of High Functionality	Climate Stability – Carbon Storage	Climate Stability – Reduced GHG Emissions	Air of High Quality	Resilience to Flooding	Resilience to Fire
TARGET	Encourage the integration of landscape into all relevant areas of policy - cultural, economic and social (ELC)	EU - To halt the loss of biodiversity by 2010 (EU Sustainable Development Strategy, 2006)	Prevent further deterioration of, and achieve good ecological status in all water bodies by 2015 (Water Framework Dir)	To promote the sustainable use of water and mitigate the effects of droughts (WFD and Commission Communication)	Ensure the sustainable use of soil by preventing further degradation and restoring degraded soils (Soil Thematic Strategy)	To ensure the sustainable use of soil (Soil Thematic Strategy) To protect soil as a carbon store (Kyoto Protocol)	EU - 8% overall reduction in greenhouse gas emissions below 1990 levels by 2012 (not just agriculture) – Kyoto Protocol	Limits set for 2010 emissions of sulphur dioxide, nitrogen oxides, ammonia & volatile organic compounds by MS (NECD)	To reduce the probability of flooding and its potential consequences (Flood Directive)	None identified

Costs of actions to be borne by society:

- Incentives - Compensation - Market Based Instruments - Advice, Capacity Building

	Agricultural Landscapes	Farmland Biodiversity	Water of High Quality	Water Availability	Soils of High Functionality	Climate Stability – Carbon Storage	Climate Stability – Reduced GHG Emissions	Air of High Quality	Resilience to Flooding	Resilience to Fire
LEGISLATIVE REQUIREMENTS	No EU baseline Varying national legislation - many in GAEC	EU – Designation of protected sites; Protection of listed species, their breeding sites and resting places (Birds & Habitats Directives) Various national legislation	EU - Limit of 170 kg N/ha to agricultural land EU – 0.1 µg active substance /l groundwater National restrictions on applying inputs Possible further Restrictions via WFD implementation	No EU legislative requirements Varying national authorisation procedures for use of water for irrigation By 2013, mandatory controls on abstraction of ground and surface water under WFD measures by 2013	EU – Restrictions on inputs to soil (Nitrates, Sewage Sludge, Groundwater Directives) Potential for further restrictions if draft Soil Framework Dir is adopted	No EU or national legislative requirements	No EU or national legislative requirements	EU – Emissions minimisation requirements under IPPC relate to intensive industrial agricultural units (mainly pigs and poultry)	No EU legislative requirements By 2015, mandatory measures to be introduced in MS to prevent and reduce the likelihood and impact of flooding (Flood Directive)	No EU legislative requirements Some national legislation

IMPROVED ENVIRONMENTAL DELIVERY

5 CURRENT POLICY MEASURES FOR THE DELIVERY OF PUBLIC GOODS

5.1 Introduction

In Chapter 4, the need for public support to ensure the provision of the public goods that form the focus of this study was established. The aim of this chapter is to provide a catalogue of the different means of financial support currently used within the EU to support those actions required for the delivery of environmental public goods by farmers. As set out in Chapter 4, the setting of the reference level and targets is not uniform across all Member States and therefore the scope for where payments can be made to farmers as providers of public goods will differ between Member States and may also change over time.

Given our focus on the public goods provided through agriculture in the EU, the CAP, with a budget of €53 billion per annum, is the most important policy instrument that exerts an influence on agricultural land management across the EU and therefore has considerable potential to influence the scale of delivery of public goods. For this reason it forms the main focus of this chapter.

The CAP originated under the Treaty of Rome (1957) as a series of mainly market interventions designed to increase agricultural productivity, to provide income support to European farmers, and to protect them from external competition. Over time, it has undergone numerous reforms, with the main outcomes being the decoupling of direct support from production, and the introduction of measures that support environmental management and broader rural development activities.

In addition to the CAP, dedicated funding for biodiversity also exists - but at a much smaller scale - and is administered through the LIFE+ programme, the Structural Funds as well as specific national measures in all Member States.

There are few examples of alternative dedicated funds to support the delivery of other public goods such as climate stability, soil functionality or water quality, although funding through the LIFE+ programme can also be used to meet these objectives.

Focusing on the set of ten challenges presented in Chapter 4, this chapter examines the way in which CAP measures, alongside other relevant policy measures, are currently being used to respond to these challenges, both directly and indirectly, albeit in recognition that many are not explicit objectives of the current policy framework. A brief commentary on the effectiveness of current policy support measures leads to an assessment of the degree to which these challenges are being met, leading in the final section to a discussion of the improvements that may be made to the existing policy framework to ensure the ongoing delivery of public goods in the future.

5.2 Addressing the Undersupply of Public Goods

Addressing the undersupply of these public goods can be achieved both directly and indirectly through a range of policy support measures, with the CAP being the main instrument used at present. The focus of support can take a number of forms, including: support for maintaining or introducing farming practices benefiting the environment; support to maintain and improve the skills, understanding and knowledge base of farmers; and support for environmentally focused infrastructure investments on farms, within rural areas more broadly and across the supply chain. In addition, for many Member States (for example, many of the more rural, and new Member States) a key concern is the need to ensure that sufficient people remain in rural areas.

The current range of policy instruments and measures used to address the challenges identified in the previous chapter can be divided into three broad groups. Firstly there are those measures where the provision of environmental public goods is the primary rationale. These generally take the form of payments for maintaining or introducing environmentally beneficial land management practices. Some of the Axis 2 measures within Rural Development policy, such as the agri-environment measure, fall within this group.

Secondly, there are those measures which, although enhancing the environment is not their primary rationale, do contain reference to improving the sustainability of agriculture or enhancing natural capital amongst their objectives. Support under such measures has the potential to fund actions that bring about environmental improvements. Examples of such measures are the farm modernisation, and advice and training measures within Axis 1 of the Rural Development policy, certain Axis 2 measures, such as the natural handicap payments for the Less Favoured Areas (LFA), or the Axis 3 measure for training and information. It should be noted, however, that certain of these measures may also be used to support actions at the farm level that do not deliver public goods and that they may cause environmental degradation unless appropriate conditions and safeguards are enforced effectively.

Thirdly, there is a group of measures the impact of which on the environment is much more indirect in nature. Measures within this group do not have any environmental objectives but they may have an impact on the provision of public goods. The decoupled direct payments under Pillar One are one example of this sort of measure, as is the farm diversification measure under Axis 3 of Rural Development policy, both of which can make a substantial contribution to farm incomes. A large number of farms in receipt of these payments deliver public goods and certain of these may rely on those payments to maintain their economic viability, thereby enabling them to continue to provide public goods. Other farms in receipt of these payments, however, may not be providing public goods and indeed may engage in activities causing environmental degradation unless appropriate conditions and safeguards are enforced effectively.

Table 5.1 sets out the range of EU policy measures that have the potential to support the provision of public goods, grouped according to whether they are directly or indirectly focused on achieving environmental outcomes. The grouping of the measures is based on an assessment of their logic of intervention (see Annex VIII). The differences in the funding allocated to individual measures are quite substantial. Expenditure under Pillar One continues to account for a large proportion of the CAP budget, with a total allocated expenditure of €286 billion for the 2007 – 2013 period, with only €86.6 billion allocated Rural Development policy, rising to €144 billion when national co-financing is taken into account[8] (see Annex IX for a detailed breakdown of the Rural Development policy budget for relevant rural development measures in the EU-27 Member States).

In the following section, these support measures are examined in more detail. For clarity of presentation, the analysis of their use and effectiveness in responding to the challenges associated with the provision of public goods has been organised around two key groups of public goods. The first group includes agricultural landscapes and farmland biodiversity, and the second includes water quality and availability, soil functionality, climate stability, air quality, and resilience to fire and flooding. This grouping reflects differences both in the nature of the relationship between agricultural management and the provision of these public goods, as discussed in Chapter 2, as well as in the nature of the most appropriate policy response.

[8] Figures in this chapter do not take account of the additional funds for rural development resulting from increased modulation rates under the CAP Health Check Agreement.

Table 5.1 Policy measures and their potential to support the provision of environmental public goods

Measures with a direct focus on the provision of public goods	
CAP – Rural Development: Agri-Environment measures	Agri-Environment (214) Non-Productive investments (216)
CAP - Cross compliance - GAEC standards implemented at national/regional level*	GAEC standards that specify actions beyond existing legislation focusing specifically on maintaining landscape features, maintaining habitats, maintaining soil functionality or maintaining water quality.
CAP – Article 68 of Council Regulation 73/2009	Special support for : i) specific types of farming which are important for the protection of the environment - Art. 68 (1)(a)(i) ii) specific agricultural activities entailing additional agri-environment benefits - Art. 68 (1)(a)(v).
CAP – Cross compliance	Permanent Pasture requirements under Article 6(2) of Council Regulation 73/2009
LIFE +	Agriculture focused projects
Structural Funds	Projects under the heading 'Preservation of the environment in connection with land…and landscape conservation' (code 1312).
Measures with a partial focus on the provision of public goods	
CAP – Rural Development	Advice and training measures (111, 114, 115) Farm modernisation (121) Infrastructure development (125) LFA payments (211, 212) Natura 2000 (213) Conservation and upgrading of the rural heritage (323) Training and Information (331)
Measures with no direct focus on the provision of public goods, but that may have a positive impact	
CAP – Rural Development	Adding value to agricultural products (123) Diversification (311) Encouragement of tourism activities (313)
CAP – Decoupled direct payments and cross compliance GAEC standards implemented at national/regional level*	Payments to stabilise farm incomes GAEC standards that specify actions that go beyond existing legislation that avoid the encroachment of unwanted vegetation or specify minimum stocking rates.
CAP – Article 68 of Council Regulation 73/2009	Special support to address specific disadvantages affecting farmers in the dairy, beef, veal, sheepmeat and goatmeat and rice sectors in economically vulnerable or environmentally sensitive areas, or in the same sectors, for economically vulnerable types of farming – Art. 68 (1)(b).

* Only those GAEC standards that are not included as part of national legislative requirements are relevant here, as those that reflect EU and national legislation form part of the reference level as set out in Chapter 4.

5.3 Policy Measures for Landscape and Biodiversity

There is a set of policy challenges that includes maintaining the diversity and distinctive character of agricultural habitats and landscapes, facilitating the adaptation of species and habitats to climate change, maintaining and restoring farmland biodiversity, and conserving the genetic resource, that all require some form of appropriate and sustained management of agricultural land. Addressing these challenges involves supporting activities both to maintain and extend appropriate forms of agriculture and the beneficial practices required to deliver the public goods in question, as well as to avoid the loss of environmentally valuable agricultural land to other land uses, such as urban development or land abandonment.

5.3.1 Policy Measures with a Direct Focus on Public Good Provision

Historically, landscape and biodiversity conservation have been primary objectives of environmentally focused incentive schemes in many EU Member States. Many of the earliest agri-environment schemes, for example in France, Germany and the UK during the 1980s and early 1990s, were designed to maintain traditional landscapes at threat from agricultural intensification and structural change, and to protect species and habitats of national importance that were either in decline or at risk of decline. Given the continued threats to the condition of these public goods across Europe, a number of policy measures have landscape and biodiversity protection and enhancement as core objectives. It should be noted that because the regulatory baseline with regard to both landscape and biodiversity varies between Member States (see Chapter 4 and Annex VII), the actions for which farmers can be rewarded to benefit landscape and biodiversity also vary.

CAP – Rural Development: Agri-Environment Measure

Of all the policy measures, it is the Rural Development Axis 2 measures, and specifically the agri-environment measure, which are most directly focused on the maintenance and improvement of agricultural landscapes and farmland biodiversity. As the only compulsory rural development measure, the agri-environment measure is the most significant both in terms of its spatial coverage and the financial resources allocated to it. In the current 2007 – 2013 programming period, it is anticipated that nearly three million farms across the EU-27 Member States will be supported by agri-environment payments, covering a total area of almost 39 million hectares (European Commission, 2008). This accounts for approximately 22 per cent of the total Utilised Agricultural Area (UAA), with a programmed budget of €34 billion (including national co-financing), equating to approximately 23 per cent of the total rural development budget, and 12 per cent of the total CAP budget for 2007 - 2013. A large proportion of these funds are targeted at achieving biodiversity and landscape outcomes as the majority of Member States include the protection of cultural landscapes and farmland biodiversity as a key priority of their agri-environment schemes.

There has been some debate about the effectiveness of agri-environment schemes for delivering biodiversity linked to the difficulties inherent in quantifying the environmental benefits achieved (for example, ECA 2005; Kleijn *et al*., 2006; CSL and CCRI, 2008). In general, however, evaluations of the agri-environment measure have shown that its implementation has achieved benefits for biodiversity, or at least reduced the rate of biodiversity loss, largely due to the focus of many schemes on the maintenance of existing low intensity systems, extensifying production and on reducing agrochemical inputs (EPEC, 2004; Oréade-Brèche, 2005; Kleijn *et al*., 2006; CSL and CCRI, 2008). In contrast, there is less evaluation literature that sets out how effective these schemes have been in achieving landscape objectives, perhaps partly because this is more difficult to measure. However, a recent evaluation (Oréade-Brèche, 2005), backed up by evaluations of agri-environment schemes in the UK and elsewhere, showed that the measure has had a generally beneficial impact upon maintaining landscape patterns, particularly through the maintenance, restoration and recreation of landscape features, the maintenance of habitat mosaics, the reversion of arable land to grassland, the maintenance of extensive grassland, and the prevention of land abandonment in some cases.

The unsuitability of indicators for measuring scheme success has been a key criticism of the European Court of Auditors in relation to agri-environment schemes (ECA, 2005), although the recent development of new indicators to facilitate greater integration of environmental concerns within agriculture, together with the introduction of the Common Monitoring and Evaluation Framework (CMEF) as part of rural development policy will go some way to address this as baseline indicator data, as well as data relating specifically to measure and programme impacts, are collected over time.

The high level of subsidiarity associated with rural development measures in general, and the implementation of the agri-environment measure in particular, means that the design and delivery of agri-environment schemes across and within Member States has the potential to be extremely varied. They can take a number of forms depending upon the nature of the outcome desired, for example, whether widespread environmental benefits are required across the majority of the farmed landscape, or more specific actions are needed within specific locations. Targeting can be achieved through the design of appropriate eligibility criteria, environmental conditions and management requirements.

The design of agri-environment schemes in many Member States tends to favour schemes intended to have broad reach and achieve maximum coverage of the farmed landscape, requiring farmers to undertake relatively simple management techniques across the whole farm, often promoting the maintenance of existing extensive grassland management. Examples of such approaches to agri-environment schemes are set out in Box 5.1. More targeted, discretionary schemes focusing on objectives set for specific habitats in particular locations, or at improving the delivery of biodiversity or landscape diversity within more intensive farming systems, are less frequent. There are some exceptions, however, with Germany and the UK both targeting at least a part of their schemes at specific areas of biodiversity and landscape value.

More recently, certain Member States have started to introduce options for creating field margins and buffers strips within arable systems, over and above those which are required under cross compliance. These can have significant benefits for biodiversity (for example, birds, small mammals, butterflies). The great majority of Member States also use the agri-environment measure to encourage organic farming practices, providing incentives to cover conversion costs and in most cases, to provide payments for the maintenance of these practices which have been shown to have significant biodiversity benefits (see Chapter 3). Examples of schemes that have been targeted at the delivery of biodiversity and landscape benefits are set out in Box 5.2.

Agri-environment schemes that are well designed according to regional needs, with clear objectives and with prescriptions that are focused on the specific management requirement of particular habitats, species or features, tend to deliver more for biodiversity than those that are more broad brush in nature, requiring little more than the continuation of existing management practices, particularly if these are focused on farming systems generating low levels of environmental benefit (CSL and CCRI, 2008). More broad brush schemes are more effective where the existing management is predominantly appropriate and the main challenge is to keep it in place (IEEP, 2007).

With more targeted schemes, however, come higher transaction costs, both for the public administration and for the farmer, with the highest transaction costs likely to be associated with those schemes targeted at achieving specific outputs on specific sites. Often these are characterised by low participation relative to less targeted, area wide schemes (Vatn, 2002). While precise targeting, whether at the habitat or farming system, is considered to be a more effective means of improving the provision of public goods compared to simple area wide schemes, for administrative, financial and political reasons, a balance often needs to be sought between the higher administrative costs associated with more targeted approaches, and the additional benefits that might be achieved (Vatn, 2002; Eggers *et al.*, 2007; OECD 2007a).

Box 5.1 Selected agri-environment measures supporting basic grassland management

In the **Czech Republic,** national measures supporting the basic management of meadows/pastures are offered with premia of ~75/112 €/ha with limits imposed on fertiliser and herbicide application, grazing and grassland restoration and mulching, as well as restrictions on dates for mowing.

In France, the nationally offered "extensive grassland premium" (76€/ha) for farms with at least 75% of grassland requires limits on fertiliser use, grassland conversion and renewal as well as the maintenance of a minimum share of 20% of landscape elements on the committed area.

In Germany in Baden-Württemberg, basic grassland measures are offered over the whole area under MEKA III (one part of the regional RDP) with the objective of avoiding the abandonment of grassland while ensuring extensive management (with restrictions on fertiliser and pesticide use, ploughing, time of cutting, and livestock density). These measures may be combined with additional measures for maintaining grassland on steep hills and an outcome oriented measure which requires farmers to prove the existence of four indicator grassland species from a list specific to the region.

In Italy (Veneto), measures for the maintenance of grassland (214/e1-3) are expected to cover a considerable share of the area's grassland (result indicator: 67,700 ha; of a total agricultural area in mountain areas of 117,980 ha in 2007). They are predominantly aimed at mountain areas (farms with at least 51% of their land within mountain areas) and Nitrate Vulnerable Zones (NVZ). Measures include limits to fertiliser and pesticide use and consideration of bird nesting times.

In **Sweden,** the basic grassland measures are offered to all permanent grassland. Approximately €108 is paid to farmers for the annual management of grassland (by grazing or harvesting respectively), and avoiding accumulation of organic matter and encroachment of bushes. The application of fertiliser and pesticides is forbidden on permanent grassland in Sweden.

In England, the current agri-environment scheme (Environmental Stewardship) includes three elements: Entry Level Stewardship (ELS) - a broad based scheme aimed at all farmers; Organic Entry Level Stewardship (OELS) and Higher Level Stewardship (HLS) - a more targeted scheme. ELS comprises a range of management options, designed so that all types of enterprise (arable, livestock, mixed etc.) are able to participate in the scheme. Each option is worth a certain number of points, depending on the environmental land management required and the associated income foregone. The ELS contains measures for extensive grassland management with low/very low inputs (premia up to ~174 €/ha) (covered by 20-30 per cent of ELS agreements in the case study region), for management of rush pastures and support for mixed grazing.

Box 5.2 Selected grassland agri-environment measures targeted at specific habitats or protected areas

In the **Czech Republic**, higher premia are paid for mesophilic/hygrophilic and mountainous/xerophilous meadows, with stricter limits on fertiliser use. Additional measures provide support specifically for bird habitats on grassland with up to ~200 €/ha. Another measure is explicitly directed at the maintenance of species-rich pastures (without additional fertiliser) with a payment of 169€/ha. These measures are offered at a national scale with no differentiation of premia or requirements according to local conditions.

In **France** (Auvergne), in addition to 57 national measures offered under the national extensive grassland premium, a menu of regional top-up measures is offered. The regional measures are only eligible in areas of Natura 2000 sites and areas as identified as priorities under the WFD. The regional grassland measures include, for example, further limits on fertiliser use, adjustment of grazing, delay of cutting or grazing, and in combination with the baseline measure amount to maximum payments of between 211 - 272 €/ha.

In **Germany** in Baden-Württemberg, extensive forms of management of high nature value habitats are supported under MEKA III with payments of 140€/ha. Requirements are adapted to local conditions. Under the regional RDP, the Landscape Care Guidelines (LPA), in particular, offer measures for extensive management of grassland to support nature conservation objectives. Only certain biotopes, protected areas or certain project areas are eligible. Most of the measures are performance-oriented, for example the grassland habitat has be of a certain quality, with supplements available for additional actions to protect endangered species.

In **Italy** (Veneto), further additional grassland measures are targeted specifically at semi-natural habitats and biodiversity protection, certain NVZs, classified wetlands, designated reclamation lands and flood plains, certain Natura 2000 sites and areas in the plains. Premia may be as high as 286€/ha.

In **Sweden**, farmers receive payments of between ~245€/ha and 343€/ha to undertake appropriate management of pastures and traditional meadows with high environmental values. An official of the county board determines if particular grassland is eligible and establishes a detailed, site-specific management plan (for example specifying time of mowing or grazing, type of grazing animals, state of the vegetation at the end of the vegetation period, management of landscape elements). If the grassland concerned does not qualify for the SFP, premia are higher (363€/461€/ha). There are also specific additional payments available to scythe mowing (686€/ha), grazing after hay making, or for lopping trees. Further measures support traditional forest grazing with payments of 230€/ha and summer farm (transhumance) grazing. Two other measures are targeted at areas that are not eligible for the SFP: maintenance and enhancement of mosaic pastureland and other poor grassland (196€/ha in Östergötland) and restoration of pasture land and meadows (353€/ha).

HLS agreements in **the UK** (England) are aimed at the most valuable habitats requiring complex and locally adapted management which will deliver higher environmental benefits, including Natura 2000 sites. Most HLSs run for 10 years, and certain for up to 20 years. HLS applications are prepared by advisers and explicitly address habitat management to promote biodiversity, e.g. by supporting maintenance, restoration or creation of species-rich, semi-natural grassland, of wet grassland for breeding waders or wintering waders and wildfowl, and of grassland for certain other target species. Premia are approximately 150€/ha for maintenance/restoration of grassland for target features (e.g. bumblebees, field birds), 230€/ha for maintenance or restoration of species rich, semi-natural grassland and up to 390€/ha for maintenance/restoration of wet grassland for breeding waders. Premia for the creation of such grassland from arable, ley grassland or abandoned land are slightly higher. Some of these HLS measures can be combined with supplements (of about 90€/ha), e.g. for hay-making or raised water levels. For several of these combinations the resulting premia may exceed 400€/ha.

CAP – GAEC Standards Implemented at National/Regional Level[9]

If a farmer is to receive the full amount of decoupled direct payments, he/she has to comply with GAEC standards, some of which are more demanding than those prescribed under European and some national legislation (see Annex X). The added impact of these GAEC standards in terms of the provision of public goods very much depends on the nature of the standards set at national level, in conjunction with the stringency of national legislative requirements (see Annex VII). For example, in addition to national legislative requirements that are compulsory for all those managing the land, France requires that recipients of direct payments also place a minimum proportion of cropped land under environmental cover alongside watercourses, hedgerows and on slopes; Romania, Spain and Italy have restrictions on the removal of trees; Italy requires farmers to preserve and prevent the degradation of terraces; and the UK does not permit the removal of dry stone walls.

Linking such requirements to payments which are available to the majority of farmers helps to secure their application across a large proportion of the farmed area in the EU. Decoupled direct payments currently provide the incentive for respecting these requirements, because they can be reduced in the case of non-compliance.

CAP - Cross Compliance - Permanent Pasture Requirements

The cross compliance permanent pasture requirements under Article 6(2) of Council Regulation 73/2009 can also benefit the maintenance of grazed landscapes across Europe. While in most Member States there are no obligations to retain permanent pasture at farm level, as the trigger level stipulated under Article 6(2) has not yet been reached, certain Member States – such as the Czech Republic and Italy – have introduced bans on the conversion of permanent grassland to arable land through the introduction of additional obligations at farm level under the GAEC standard "protection of permanent pasture".

CAP – Article 68 of Council Regulation 73/2009

Although Member States have the opportunity to redirect up to 3.5 per cent of their national ceilings for direct payments to 'specific types of farming which are important for the protection or enhancement of the environment'[10], and up to

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9 Only those GAEC standards that are not included as part of EU and national legislative requirements are dealt with here, as those that reflect EU and national legislation form part of the reference level as set out in Chapter 4.

10 Article 68(1)(a)(i) of Council Regulation (EC) No 73/2009.

10 per cent to fund additional agri-environment measures[11], only selected Member States have chosen to use Article 68 for this purpose. On the basis of the information available on what Member States plan to do, nine intend to redirect Pillar 1 funds for environmental purposes. Ireland, France, the Netherlands, Poland, Portugal and Finland have decided to support specific types of farming which are important for the environment, while Italy, Denmark, Spain, France and Portugal intend to make use of the option to redirect funds to additional agri-environment measures, which require Commission approval. For example, Portugal is proposing to introduce two agri-environment schemes: the first to maintain traditional olive plantations, important for biodiversity, landscape and cultural heritage, and which are at risk of abandonment; and the second, to maintain natural pastures of High Nature Value by supporting extensive grazing practices. Romania has notified a measure supporting organic farming but this is under the quality provision of Article 68[12].

EU LIFE+ Programme

The EU LIFE+ funding programme covering the 2007 - 2013 period, provides up to €250 million for the co-financing of projects under three headings: nature and biodiversity; environment policy and governance; and information and communication. Since 1992, 11 per cent of all LIFE Environment funded projects have been related to agriculture, with half of these focusing on improving technology, 43 per cent focusing on developing methodological tools, and 7 per cent focusing on awareness raising activities. Despite the relatively low levels of funding available compared to other policy instruments (such as the Rural Development policy), LIFE+ projects have made an important contribution to the implementation of Member State Biodiversity Action Plans (BAPs) through projects to restore habitats, pilot new agri-environment measures, and to test the benefits for biodiversity of introducing particular land management techniques such as extensive grazing or mowing regimes. For example, in Baden-Württemberg, Germany, LIFE+ funding is being used to fund conservation actions to help protect orchard meadows – an important habitat for certain bird species, and in Sweden, Östergötland county is managing a LIFE+ project "Rosoris" which focuses on the restoration of oak-wooded grassland within Natura 2000 areas.

In addition to EU funding instruments, a number of Member States use national initiatives to fund projects that achieve biodiversity and landscape objectives. Some of these national initiatives are approved by the EU on the basis of common state aid rules, ensuring the compliance with existing WTO principles. Examples of these are included in Box 5.3 below.

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11 Article 68(1)(a)(v) of Council Regulation (EC) No 73/2009.

12 Article 68(1)(a)(ii) of Council Regulation (EC) No 73/2009.

Box 5.3 Examples of national policy instruments used to support landscape and farmland biodiversity

Landscape: In the UK, the Heritage Lottery Fund finances community involvement projects that explore different aspects of the heritage of local areas. For example, under the Suffolk Changing Landscape project, and in association with the local planning authorities and the AONB, a small grant has been awarded to fund participants from 153 local Women's Institute groups to survey their local landscape and to record its character through mapping and photography, with the results used to test the effectiveness of planning policies in protecting and enhancing landscape character (UK case study).

Austrian tourism communities - Farmers in certain Austrian tourism communities receive voluntary local compensation payments for providing agricultural landscape services. Hackl *et al*. (2007) studied 266 communities in Austria and found that 15% reported voluntary payments for landscape enhancing agricultural activities in 1993, rising to 49% in 2000. Typical annual payment rates are €50 per hectare for cultivating an area, €100 per livestock unit kept on mountain pastures during summer, and €79 for mowing steep Alpine meadows (sourced from Rollett *et al*., 2008).

***Farmland Biodiversity / Ecological Integrity**:* In 2006, the French bird protection association (LPO) introduced a 5 year national initiative to promote biodiversity on farmlands. In the Auvergne region, a network of 20 farmers has been involved. After a first year of trials, measures were developed and implemented by participating farmers, including pond restoration or creation; restoration of *bocage* pattern; protection of wetland areas; hedgerows and small woodland plots; protection of wild orchids (French case study).

Genetic Diversity: In the UK, a Yorkshire Dales National Park led partnership aimed to restore and enhance 1500 hectares of wildlife habitat by encouraging a return to mixed farming and the re-introduction of cattle. The project facilitated the production of management plans, provided advice and funding to landowners and ran best practice demonstration events (Swales, 2009).

5.3.2 Policy Measures with a Partial Focus on Public Good Provision

CAP – Rural Development Measures

The ex ante evaluations of the 2007 - 2013 programmes (AEIDL, 2008), mid term evaluations of the 2000 - 2006 programming period (Agra CEAS, 2005), a recent evaluation of Rural Development policy by BirdLife International (BirdLife, 2009b), as well as evidence from the case studies, show that a range of other rural development measures have the potential to deliver biodiversity and landscape benefits. Although the environment does not feature as the central objective for these measures, improving environmental sustainability or the environmental status of the farm is identified as one of their possible uses. Within this set, those measures that are most often used to deliver biodiversity and landscape benefits include: training and advice measures (111, 114, 115), the LFA measures (211, 212), the Natura 2000 measure (213), the training and information measure (331) and the conservation and upgrading of the rural heritage (323).

Specifically, the measure for 'conservation and upgrading rural heritage' has considerable potential to fund large scale projects including ecological restoration, landscape-scale ecological infrastructure, studies and plans. One of the most common actions currently supported is the development of management plans for Natura 2000 sites, as is the case in both Spain (Extremadura) and Germany (Schleswig Holstein). In Spain, other actions for nature conservation are also eligible, including projects supporting endangered species (including their reintroduction), managing and gathering information on biodiversity, and the restoration of traditional pathways for transhumance etc (BirdLife, 2009b). However, only one per cent of total public expenditure allocated to rural development measures in the EU-27 is focused on this measure (€1.4 billion).

Although not an explicit aim of the natural handicap measures, LFA schemes in different guises have been used to support extensive livestock based systems over the past 30 years which are crucial to the maintenance of species rich semi-natural pastures and the avoidance of land abandonment (IEEP, 2006). However, evaluation studies have shown that while payments have contributed to continued agricultural land management in marginal areas, the measure is not targeted at areas of greatest biodiversity value or where the risk of land abandonment is greatest (IEEP, 2006). Together, the two natural handicap payment measures account for approximately 14 per cent of the total rural development budget or €20 billion (including national co-financing). This varies significantly across Member States depending on both the proportion of land designated as LFA and the eligibility criteria which are determined by Member States.

A key element of nature conservation policy in the EU is the Natura 2000 network, encompassing Europe's most important sites for biodiversity. In the EU-27 Member States, 31 per cent of Natura 2000 sites are under agricultural land management, the share in most Member States varying between 20 and 40 per cent. Of this, more than 8.6 million hectares of pasture - over 18 per cent of total pasture land across the EU-27 Member States - are within Natura 2000 sites, and are therefore largely dependent on the continuation of appropriate agricultural practices (see Chapter 3). The Natura 2000 measure[13] within Rural Development policy provides support to compensate for the additional costs of undertaking appropriate management on agricultural Natura 2000 sites, in order

13 The main purpose of the Natura 2000 measure in EAFRD is to provide income support to farmers to compensate for meeting the legal requirements set out under the Birds and Habitats Directives on these sites. However, because Natura 2000 areas are designated for their biodiversity value, these requirements seek to maintain or improve the conservation status of these sites and as a result, payments to farmers under the Natura 2000 measure are focused on the provision of biodiversity benefits.

to ‘maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest’[14].

The choice of how Natura 2000 obligations are met is left to Member States according to the principle of subsidiarity, and can involve statutory, administrative or contractual measures. Achieving favourable conservation status of Natura 2000 sites will depend on actions by farmers to carry out the management practices needed to achieve the objectives. While some of these may be required through the imposition of mandatory standards, others are achieved through the provision of support for actions that go beyond mandatory standards. This support is often provided through the agri-environment measure as an alternative to the Natura 2000 measure. Expenditure on the latter is, however, rather low across the EU (0.5 per cent of total public expenditure), with it mainly being used in the new Member States.

Box 5.4 Policy measures used within Natura 2000 sites to support biodiversity

In some Länder in **Germany**, certain Natura 2000 sites are also designated as nationally protected nature conservation areas, with specific ‘protected area regulations’ setting out the rules for the area, for example, banning the ploughing of grassland, preventing changes to water levels, or imposing requirements to retain certain landscape features within Natura 2000 sites, meaning that the costs of these requirements are borne by the farmer. However some Länder, among them Baden-Württemberg, offer Natura 2000 payments as compensation for meeting these requirements. In addition, agri-environment measures are available, with the “Landscape Care Guidelines” scheme specifically targeted at protected areas, including Natura 2000 sites.

In **France**, apart from general prescriptions based on the Birds and Habitats Directives, no concrete mandatory prescriptions apply for farmers with land in Natura 2000 sites. The delivery of Natura 2000 objectives is supported through the rural development programme, which offers farmers area-specific measures designed to target specific objectives relating to the site in question.

In **Italy** (Veneto), binding prescriptions resulting from Natura 2000 management plans are compensated through Natura 2000 payments. In addition, an agri-environment measure (maintenance of the grassland with high historical and nature value) is specifically targeted at Natura 2000 grassland sites in the plains. It is possible to combine both agri-environment and Natura 2000 payments.

In **Spain** (Andalusia), the majority of management required within Natura 2000 sites is achieved through the imposition of mandatory restrictions, with a limited number of agri-environment measures targeted at approximately 20 per cent of agricultural land within Natura 2000 sites. When applying for other support measures (for example, LFA), farmers located in Natura 2000 sites are prioritised.

In **England**, Potentially Damaging Operations (PDOs) are identified for every Natura 2000 site

[14] Article 2(2) of the Habitats Directive, Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, OJ L 206, 22.07.1992.

and these are not permitted. Positive management is prioritised through Higher Level Stewardship (HLS), and action plans for restoring and enhancing the ecological condition of Natura 2000 sites using HLS management options. Agri-environment funding is the major source of support for management of Natura 2000 farmland habitats. A voluntary approach is taken to ensure the positive management of Natura 2000 sites because of the difficulties in imposing mandatory requirements, and the importance of the co-operation of the land manager to successful, effective management. Reserve (mandatory) powers to require specific positive management are available, but are very seldom used.

5.3.3 Policy Measures with no Direct Focus on the Provision of Public Goods, but that may have a Positive Impact

CAP - Decoupled Direct Payments and GAEC Standards Implemented at National/ Regional Level[15]

Decoupled direct payments (amounting to approximately €286 billion over the current financial perspective) support and stabilise farm incomes. Where these payments make a critical contribution to the economic viability of farms, they thus help to keep farming activity in place. This is a precondition for being able to apply more targeted actions for public goods provision through Rural Development measures. In this way, direct payments can contribute indirectly to the supply of public goods.

Decoupled payments form a significant proportion of total farm income of most of those farmers managing the land within marginal areas (Swinnen *et al.*, 2008). However, while direct payments reduce risk in farming households by providing a guaranteed source of income, and have the effect of maintaining farming in certain areas, they are not specifically targeted at those farms that are most economically vulnerable or those that deliver the most for public goods, as payments continue to reflect the historic distribution of coupled direct payments (Nuñez-Ferrer and Kaditi, 2008; Velazquez, 2008). In those Member States which have chosen to introduce flat rate payments (for example, Germany and the UK), the overall distribution of payments shifts to favour farms that have been managed more extensively in the past (Farmer *et al*., 2008; Osterburg *et al*., 2008).

The GAEC standards to avoid the encroachment of unwanted vegetation or set minimum livestock stocking rates encourage land to be kept under agricultural management. Although the purpose of these GAEC requirements is to retain the productive capacity of the land, they also help to prevent the proliferation of invasive species, maintain open landscapes and limit the abandonment of farmed land and its reversion to scrub and ultimately woodland. The advantage

[15] Only those GAEC standards that are not included as part of national legislative requirements are dealt with here, as those that reflect EU and national legislation form part of the reference level as set out in Chapter 4.

of linking cross compliance requirements to payments that are received by the vast majority of farmers in the EU is that agricultural areas across the EU have to be managed in a way that is compliant with a range of GAEC standards that exceed requirements in EU and national legislation.

There is a proportion of agricultural land in Romania and Bulgaria specifically, but also in other Member States to some extent, which is often of environmental value but falls outside the decoupled direct payment system entirely. This is either because the farm size falls below the eligibility threshold, or because of eligibility issues excluding land with a significant proportion of scrub existing on the holding. The restrictions on the proportion of scrub and woodland that is permissible for land to be eligible for the Single Payment means that land that is of biodiversity and landscape value risks becoming ineligible for payments. For example, a recent study in Germany (DVL and NABU, 2009) showed that areas of heathland with less than 50 per cent of grass are ineligible for decoupled payments, in contrast to the approach taken in some other EU countries, such as the UK. This leaves a proportion of farms within High Nature Value farming systems even more fragile economically than they might otherwise be, leading to a greater risk of losing the environmental benefits that they generate (Romanian, Swedish and German case studies).

CAP – Article 68 of Council Regulation 73/2009

In addition to the direct support they can provide to the environment (see section 5.3.2 above), the use of specific support measures under Article 68 (1) (b) of Council Regulation 73/2009 can also help to support, in an indirect way, the maintenance of biodiversity and agricultural landscapes, by keeping land in agricultural management through the support of specific sectors in environmentally sensitive areas. In the past, however, the use of such provisions by Member States to support sectors that may have environmental benefits, such as extensive suckler cows, is not common (Alliance Environnement, 2007; Hart and Eaton, 2008). While the extent to which Member States will utilise the new provisions in ways that will deliver environmental benefits is not yet clear, two Member States (France, Slovenia) plan to redirect a proportion of their direct payment budget to the dairy sector 'in mountain areas'. Greece and Romania intend to use this measure to provide additional funding for supporting the dairy sector in their Less Favoured Areas. The other Member States intending to make use of Article 68(1)(b) of Council Regulation (EC) No 73/2009 are Belgium, Czech Republic, Estonia, Ireland, Spain, Latvia, Hungary, the Netherlands, Poland, Portugal Slovakia and Finland. Most of the measures chosen to be implemented aim to grant support to dairy farmers, although it is not possible to assess what proportion of the support may be channelled to extensive systems.

CAP – Rural Development Measures

Measures that have the potential to provide indirect support for the maintenance and enhancement of landscapes and biodiversity include the Axis 1 measures promoting participation in food quality schemes, particularly where the use of the measure is linked to sustainable land management practices such as those supported by agri-environment schemes. However, although some Member States use these measures to support organic certification, there is no requirement to use them to improve the environmental credentials of food products. For example, in Spain (Extremadura), amongst the PDOs that receive support are the "dehesa de Extremadura" ham and "La Serena" cheese, both of which are associated with HNV farming systems. However, the "dehesa de Extremadura" PDO also includes two additional denominations which are not linked to extensive production systems (Beaufoy, 2007).

5.4 Policy Support Measures for Water Quality and Availability, Soil Functionality, Climate Stability, Air Quality, and Resilience to Fire and Flooding

The challenges associated with achieving good ecological status in all water bodies, improving levels of water availability, improving the functionality of agricultural soils, increasing the carbon storage capacity of agricultural soils, reducing greenhouse gas emissions from agriculture, and increasing the resilience of agricultural land to flood risk, all involve limiting agriculture's environmental impact to a certain degree. There is a layer of legislative requirements that apply to farms in relation to this cluster of public goods and although this is not the case across the board, environmental legislation plays a major role in stipulating a maximum level of degradation that is acceptable to society (as demonstrated in Chapter 4).

5.4.1 Policy Measures with a Direct Focus on Public Good Provision

Rural development measures of the CAP provide direct support to address these policy challenges by supporting those actions that go beyond those in binding legislation, and as represented in various Regulations and Directives. While improving water and soil quality have been objectives of the agri-environment measure since 1992, biodiversity and landscape issues have been the predominant focus of schemes in many Member States until more recently. Under the current rural development programmes, however, there has been a noticeable increase in the use of the agri-environment and other rural development measures to improve water quality. This has been either through incentivising sustainable land management practices - particularly those that reduce nutrient leaching and soil erosion - or by funding investments in improved infrastructure, particularly in relation to waste water treatment.

Many of the actions supported within existing agri-environment schemes will also provide these benefits for the preservation of carbon stocks within agricultural soils and semi-natural vegetation, although this has not been an overt objective of CAP measures to date.

In many Member States, flood mitigation policy is the responsibility of national governments. That said, a number of measures within the CAP can be used to incentivise the management practices needed to help to improve the soil's infiltration capacity, to regulate water levels and to slow the flow of flood waters to help reduce the risk of flooding. In addition, the need for Member States to establish programmes of measures by 2015 to prevent, as well as to reduce the likelihood and the impact of floods under the EU Floods Directive (2007/60/EC), is likely to mean that in future, increased attention will be paid to the role that rural development measures can play in improving resilience to flooding.

The use of rural development measures in particular for achieving climate objectives is a more recent focus for agricultural policy. For the 2007 - 2013 programming period, addressing the climate challenge is set as an objective under the Community Strategic Guidelines for Rural Development (Council Decision 2006/144/EC), particularly in relation to meeting the targets set out under the Kyoto Protocol. In addition, climate change and renewable energy was identified as one of the 'new challenges' under the 2008 CAP Health Check. A range of measures is possible, including those that improve manure management, reduce nitrous oxide emissions, raise water levels on peat soils and increase energy efficiency.

CAP Rural Development: Agri-Environment Measure

Current agri-environment schemes are used widely as a means of decreasing water pollution through increasing infiltration capacity and reducing run-off. There is considerable overlap between the management practices that are needed to improve water quality and soil functionality as practices that reduce soil erosion, soil compaction and improve soil organic matter will help to reduce erosion and the risk of sedimentation in water courses. However, although a range of management practices have been identified as beneficial for improving the functioning of soils (JRC, 2009 and see Box 5.5 below), there is a lack of information on the impact of agri-environment schemes on soil quality within the evaluation literature, with insufficient data being the main limiting factor (EPEC, 2004). Evaluations from the previous programming period relating to water quality suggest that the main benefits were delivered through actions requiring reductions in inputs, the use of cover crops, appropriate arable rotations, arable reversion to grassland and organic agriculture (Primdahl *et al*., 2003; EPEC, 2004; Agra CEAS, 2005; Oréade-Brèche, 2005). More recently, payments under agri-environment schemes have been increasingly used to incentivise the introduction of buffer strips of varying widths alongside water courses, as they are seen as a key means of achieving a reduction in the pollution of water courses, and helping to achieve good ecological status as required under the Water Framework Directive (2000/60/EU) (CSL and CCRI, 2008).

Box 5.5 Examples of agri-environment measures to encourage improved water quality and soil functionality

Within the case studies, a range of measures were identified within agri-environment schemes which contribute both to improved water quality and soil functionality:

- The establishment of green cover or catch crops on arable land (CZ, DE, RO, UK)
- The conversion of arable to grassland (CZ, IT, UK)
- Integrated production or use of biological and bio-technical processes instead of synthetic plant protection products (CZ, DE, ES)
- Payments for not applying growth regulators on cereal to reduce N-surplus and the use of fungicides
- Limiting fertiliser use (on arable land in IT, on permanent grassland in the UK)
- Promotion of organic farming methods (CZ, DE, ES, IT, UK)
- Conservation farming on arable land such as direct or mulch seeding (DE, ES)
- Creation of buffer or field strips (UK).

In addition, many of the actions funded under agri-environment schemes that are designed to deliver benefits for landscape, biodiversity, soil functionality or water quality, will also lead to improvements in the capacity of the land to sequester carbon, to improvements in the resilience of the land to flooding or to reductions in greenhouse gas emissions. Some examples of these actions are summarised in Box 5.6. Carbon sequestration can also be enhanced by appropriate conversion of farmland to woodland. A number of Member States report using the “first afforestation of agricultural land” measure as a means of enhancing the carbon storage capacity of the land, including the Czech Republic, Germany, Italy, Romania and the UK.

Box 5.6 Examples of use of the agri-environment measure to improve carbon storage, resilience to flooding and to reduce greenhouse gas emissions.

Working together, the UK water company United Utilities and the RSPB developed the Sustainable Catchment Management Programme (SCaMP), which aims to apply an integrated approach to catchment management within Bowland and the Peak District area. The programme aims to restore these upland areas to their natural hydrological condition via drain blocking, resulting in improvements to water quality and the reinstatement of valuable habitats such as upland heath and blanket bog. Funding to carry out these new management approaches has come from both agri-environment schemes and United Utilities, who work with farmers, land managers, local authorities and government to influence the management of water catchment areas (Rollett *et al*., 2008).

Agri-environment payments are used for the maintenance, enhancement and creation of wetlands (FI, FR, UK) and for the maintenance, restoration and appropriate citing of field boundaries to prevent run-off, and to act as a barrier to minimise flooding impacts (IT, ES, UK).

In CZ, the main objective of the 'conversion of arable to grassland' and 'growing catch crops' options within the agri-environment scheme is to decrease surface water runoff on arable land to minimise seasonal water shortages and to protect against short-term increase of flow rate in watercourses.

Actions under agri-environment schemes to help reduce greenhouse gas emissions include:

- Application of liquid farm-produced fertiliser in a very environmentally friendly way, with the aim to reduce Ammonia and thus GHG emissions (DE –Baden-Württemberg)
- Conservation agriculture in annual crops on slopes to reduce GHG emissions due to lower levels of machinery use (ES – Andalucia).

CAP - Direct Payments and GAEC Standards Implemented at National/Regional Level[16]

Certain GAEC standards under cross compliance require actions going beyond those set out in compulsory EU, national and regional legislative requirements in relation to water quality and the protection of soils. Many of these actions will also help to maintain or increase carbon stores, reduce greenhouse gas emissions as well as increase the resilience of agricultural land to flooding. GAEC standards differ between Member States as they are required to reflect national and local characteristics and needs.

In relation to water quality, for example, in France it is a requirement that all arable farmers must introduce 'environmental cover' on a minimum proportion of their UAA, consisting of buffer strips alongside water courses (five metres minimum), as well as on other 'relevant' areas, such as slopes, and next to

[16] Only those GAEC standards that are not included as part of general national legislative requirements are dealt with here, as those that reflect national legislation form part of the reference level as set out in Chapter 4.

hedgerows. In England, it is forbidden to crop or apply fertilisers or inputs within two metres of a watercourse, field ditch or hedgerow.

The protection of soils is a key component of GAEC standards and the majority of these are not based on any form of national legislation. These will also have benefits for water quality. While the range of standards introduced by Member States all relate to the three key issues of soil erosion, soil organic matter and soil structure as set out under Annex III of Council Regulation 73/2009, the precise rules differ from country to country to reflect the specific characteristics of the areas concerned. For example, in Italy, Germany and Romania, farmers are required to retain terraces to prevent soil erosion, but in Italy, farmers are also required to maintain them in good condition.

Many Member States require farmers not to plough a proportion of their arable land over winter or ensure that it is under some form of crop cover. However, in Germany this requirement covers 40 per cent of the cropped area and in Romania, just 20 per cent. This means that in Romania, the agri-environment measure for 'green cover crops' can be paid over 80 per cent of the cropped area, whereas in Germany, only 60 per cent of arable land is eligible. Other examples of differences in standards relate to those introduced for crop rotations, with variations in the number of crops that must be cultivated and the minimum areas to be covered. As a result of the differences in the GAEC standards introduced by Member States (reflecting the variations in conditions across Europe), the balance of what is pursued through agri-environment schemes and what is achieved through GAEC standards differs between Member States.

5.4.2 Policy Measures with a Partial Focus on Public Good Provision

CAP – Rural Development Measures

A range of measures across all four Axes of Rural Development policy have the potential to help to meet these challenges, in particular, the farm modernisation and training and advice measures under Axis 1. The farm modernisation measure - which can provide funding for capital investment - is used in a number of Member States to fund more efficient irrigation systems which improve soil and water quality, and equipment to help reduce greenhouse gas emissions. A significant proportion of total public expenditure under Rural Development policy is allocated to this measure (10 per cent or €14 billion). Indeed, only the agri-environment and natural handicap measures are allocated more, although it is not possible to identify the proportion of this expenditure that is used to support environmental outcomes. Training and advice can be used to improve management as a whole, as well as to address specific local concerns and to encourage uptake of new technologies. Farmer advice has been identified as particularly important in improving soil management in many parts of Europe (JRC, 2009), however, the extent to which different Member States have used these measures for this suite of public goods is unclear from the evaluation literature and the case studies (although see Box 5.7 for selected examples).

The case studies suggest that the conditions for private match funding of investments can restrict the extent to which smaller farms can access the funds. This is highlighted in Romania where, although semi-subsistence farmers and farmers in Less Favoured Areas are prioritised under the selection criteria for the farm modernisation measure, experience from SAPARD (Special Accession Programme for Agriculture and Rural Development) suggests that uptake amongst smaller-scale farmers can be significantly limited by the availability/accessibility of match-funding.

Although improving carbon storage capacity and reducing greenhouse gas emissions are not explicit objectives of existing CAP policy measures, these outcomes are likely to be achieved through management that is targeted at other environmental objectives, such as improved soil quality. In addition, there are a range of indicators under the IRENA operation which measure methane and nitrous oxide emissions from agriculture, and the share of total emissions derived from agriculture is both an IRENA indicator and a CMEF baseline indicator. This means that the impact of current rural development measures on these public goods may be assessed through the existing monitoring and evaluation framework for EU rural development policy.

Other policy instruments, including national and regional initiatives, particularly those relating to training and advice, are also used to meet the challenges associated with reversing the undersupply of this cluster of public goods, often in conjunction with agri-environment measures. In the UK, for example, Defra (the Department for Environment, Food and Rural Affairs) and associated environmental agencies have set up and funded the England Catchment Sensitive Farming Delivery Initiative to address diffuse water pollution from agriculture. Operating in fifty priority catchments throughout England, it aims to develop integrated strategies for dealing with the problems of water quality in priority catchments across England. Engagement with farmers is the main objective, with advice delivered through farmer events and farm visits. Management practices that go beyond codes of good practice and cross compliance are supported through agri-environment schemes. Catchment Steering Groups, involving local stakeholders, help to oversee the work in each catchment. The strategies not only attempt to deal with the management of nutrients, but also seek to promote good soil structure to maximise infiltration of rainfall and to minimise run-off and erosion (Rollett *et al.*, 2008).

Box 5.7 Examples of CAP measures with the potential to encourage improved water quality, the sustainable use of water, improved soil functionality, and reductions in GHG emissions

In *France:* actions that can be funded under the farm modernisation measure include support for investments for farmers that help to achieve reductions in pesticide and fertiliser pollution, help to control soil erosion, reduce energy usage and reduce water demand (BirdLife, 2009b). In addition, the training measures are used to provide training programmes focused on efficient fertiliser use, and the farm modernisation measure can be used for the modernisation of livestock buildings, with the aim of reducing pollution (French case study).

In *Spain (all regions) and Italy (Lombardia):* the farm modernisation and the infrastructure development measures are used to promote water saving through the modernisation of irrigation systems. To achieve real water savings, this action is restricted to farm parcels which are currently irrigated. The Aragon RDP (Spain) also includes water saving indicators, robust EIA and monitoring provisions, and stipulates that investments must contribute to the conservation objectives of Natura 2000 sites (BirdLife, 2009b).

In *Ireland, Sweden, Italy, Austria and the UK:* the Farm Waste Management Scheme in Ireland provides investment aid for animal manure storage, winter housing for cattle and sheep, silage storage and equipment for spreading animal wastes (Ireland RDP), with other countries all focusing a proportion of their farm modernisation measures on improved manure storage and spreading (case studies).

In the *Czech Republic,* the vocational training and information measure makes explicit reference to training farmers in ways to ensure the protection of soils against erosion.

In *Germany*, although the main support for renewable energy comes from feed-in tariffs for renewable electricity, rural development measures provide additional incentives. Various measures contribute to reduced GHG emissions, for example, the advice and information measure in both Axes 1 and 3 are used to provide information on energy efficiency and renewable energy, especially biomass. Investment aid through the farm modernisation measure is provided to improve energy efficiency (for example, energy efficient greenhouses) and this measure, alongside Axis 3 measures and the Leader approach are used to support the generation and use of renewable energy sources (for example, biogas plants, heating systems based on renewable energy, projects for energy crops) (Stratmann, 2008).

5.4.3 Policy Measures with no Direct Focus on the Provision of Public Goods, but that may have a Positive Impact

As noted above, decoupled direct payments (and to a certain extent Article 68 payments) provide income support which, for certain groups of farms, particularly mixed farming systems with low levels of inputs and low stocking densities, can form a significant proportion of farm income. In so doing, and in combination with other support payments under rural development policy, they provide these economically fragile farms with a degree of income stability. Where these farms are providing environmental benefits, these payments may support indirectly the continuation of practices with a lower environmental impact. As a result, they help to create the preconditions for the provision of public goods under which more targeted actions for public goods provision can be applied.

5.5 Conclusions

This chapter has reviewed the different policy support measures, mainly under the CAP, that are used to support those actions required for the delivery of environmental public goods by farmers. This review has revealed that few measures within the current EU policy framework have a direct focus on encouraging the provision of environmental public goods. The suite of measures addressing environmental public goods has, however, increased since 2003 with the introduction and subsequent expansion of the scope of GAEC standards under cross compliance and the new options under Article 68.

Of the measures with a direct focus on the provision of public goods, the agri-environment measure is the most significant. It has delivered substantial benefits for the environment, particularly in relation to maintaining landscape character and diversity and stemming the declines in biodiversity that might otherwise have been experienced. Many of the management practices that have been supported have also contributed to improving water quality and soil functionality and as a result have had benefits for other public goods, such as improving the carbon storage of soils, reducing GHG emissions or increasing the resilience of agricultural land to flooding and fire. The agri-environment measure therefore has the scope to address a large number of the challenges with respect to the provision of public goods if schemes are designed and implemented in an appropriate way and payment levels are sufficiently attractive to ensure the necessary level of take up.

Other measures within both Pillar One and Pillar Two of the CAP can also help to encourage the provision of public goods, but this focus is not part of their core rationale. These include the decoupled direct payments under Pillar One of the CAP which make a substantial contribution to farm incomes. A large number of farms in receipt of these payments deliver public goods and certain of these may rely on these payments to maintain their economic viability, thereby enabling them to continue to provide public goods.

As shown in Chapter 3, the provision of landscape and biodiversity, as well as a range of other public goods, is particularly high in extensive grazing systems and is at risk of disappearing unless sufficient funds can be found to ensure their economic viability in the longer term. It is evident that under the current policy framework, agri-environment payments alone are unlikely to be sufficient to keep farmers on the land. This would imply that to ensure the ongoing provision of public goods in less competitive regions, some form of basic income support may continue to be required to improve the stability of certain farming systems and to provide the foundation on which more targeted support to encourage the delivery of public goods can be built.

Linking direct payments to standards of Good Agricultural and Environmental Condition (GAEC) contributes to providing basic levels of public goods. Indeed, one of the main values of the cross compliance approach, including GAEC standards, is that they are able to reach the vast majority of farms and farmland across the EU, thereby helping to secure adherence to a set of basic environmental standards, some of which can be tailored to reflect local conditions.

The analysis suggests that the essential approach of pursuing environmental outcomes by combining cross compliance and incentive based measures over and above a regulatory baseline is an appropriate one. The combination of targeted measures applied under Rural Development policy and direct payments in association with cross compliance has brought environmental issues to farmers' attention in a much more prominent way, influenced a range of business and management decisions throughout Europe, helped to prevent abandonment on a significant scale, extended the application of a number of beneficial practices and contributed to the maintenance of more extensive and organic farms over a significant area.

Whilst there is evidence of undersupply in most of the key environmental public goods provided by agriculture, the current policy effort has been effective in stemming a trajectory of decline in several respects. In the face of pressures to concentrate and specialise production, to increase economies of scale and to maintain competitiveness, environmentally beneficial management practices have tended to be replaced by those that pursue efficiency gains, partly at the expense of the environment. Operating within the context of these broader economic forces, policy measures, such as the agri-environment measure, in many cases have had success in stemming the decline of beneficial management practices that might otherwise have been experienced.

That said, there are a number of reasons why the current policy framework has not achieved the improvement in the provision of public goods on the scale that is required. These relate to the relative weight afforded to the different objectives of policy, the choice of policy instruments, the design and subsequent implementation of policy measures, the extent of governance and institutional capacity and critically, the adequacy of budgetary resources. Indeed, current levels of expenditure on rural development measures with environmental objectives appear insufficient when compared to the scale of societal demand and estimates of the scale of funding required to meet EU targets for specific public goods.

Expenditure under Pillar 1 continues to account for a large proportion of the CAP budget, with a total allocated expenditure of €286 billion for the 2007 – 2013 period, compared to €144 billion for Rural Development (including national co-financing), of which €34 billion is allocated to the agri-environment measure. Calculations of the scale of funding required have been undertaken at the EU and Member State level in relation to biodiversity, soils and water quality. Estimates on the costs of managing Natura 2000 sites across the EU-25 Member States indicate that at least €2 billion per year[17] would be needed to manage agricultural land within Natura 2000 sites to achieve favourable conservation status, approximately half the annual agri-environment budget. In the Netherlands, recent estimates have shown that European funds will only be sufficient to cover 5 per cent of the funding needed to meet agreed conservation objectives for biodiversity, with similar budgetary deficiencies apparent in other Member States, such as the UK.

With respect to the scale of funding that may be needed to improve the quality of soils, the impact assessment accompanying the introduction of the Soil Thematic Strategy estimated that the costs to society of soil degradation[18] if no action were undertaken would be up to €38 billion annually. There is no overview available of the size of the budget required to achieve good ecological status of water bodies in the EU-27 Member States. However, estimates for specific river basin districts serve to demonstrate the scale of funding that may be required. For example, figures from the Netherlands suggest that €2.3 billion is needed to carry out actions beyond basic measures until 2015, with figures for the Cataluna river basin district in Spain, much higher at €6.3 billion.

Whilst the figures cited provide only rough estimates, and the funding available for enhancing environmental delivery extends beyond that provided under EAFRD, these figures serve to demonstrate the difference in the scale of funding estimated to be needed to achieve European environmental targets, and the scale of funds currently available under EAFRD. Securing sufficient budgetary resources to fund the incentive based instruments within the CAP that are critical in supporting the provision of public goods will need to be a clear priority for the future, coupled with a system of monitoring, evaluation and review to form a foundation for subsequent policy adjustment and advancement.

[17] Based on European Commission estimates (COM 2004(431)) that €6.1 billion per year is needed to manage all Natura 2000 sites, and figures showing that agricultural Natura 2000 areas constitute 31 per cent of the total Natura 2000 area.

[18] The dimensions of soil degradation included in the assessment were erosion, organic matter decline, salinisation, landslides and contamination. No estimates were possible for compaction, soil sealing and biodiversity decline.

6 SECOND-ORDER SOCIO-ECONOMIC BENEFITS ARISING FROM PUBLIC GOODS

6.1 Introduction

In addition to the inherent value of public goods to society, a range of second order social and economic benefits occur that depend, partly or wholly, on the existence of the public goods provided through agriculture. Following a dramatic reduction in farm employment over several decades in the EU-15 Member States, and more recently in the EU-12, rural regions now depend on a wide range of economic drivers for growth and development. Whilst certain areas have prospered, others face decline with out-migration, ageing, a low skills base, lower average labour productivity, in turn, resulting in a reduced social mass needed for effective public services, infrastructure and business development. There are multiple influences on the development trajectory of rural regions in the EU, however, the ability of a region to build on its environmental, cultural and social assets to derive an economic benefit is widely documented in the literature (OECD, 1998; 2006).

In certain regions of Europe, attractive agricultural landscapes and the presence of farmland biodiversity and historical features, provide a market opportunity for a wide variety of economic activities, including rural tourism and recreation speciality products and foods, as well as affording an attractive location for the establishment of businesses. The realisation of these economic opportunities depends on various factors, including an area's proximity to urban conurbations, the existence of a supporting infrastructure, such as roads, places to stay and visitor facilities, as well as factors such as geography and climate.

Economic benefits of this kind are not confined to the more vibrant rural areas. The activities necessary for maintaining and enhancing the provision of public goods can themselves provide socio-economic benefits beyond the farm household, through the generation of employment and income opportunities. For example, the provision of public goods - such as the maintenance of farmland features, terraces and stone walls - provide employment benefits for the farmer or for local contractors, as well as encouraging the retention of traditional skills. In addition, the provision of public goods allows for the differentiation of value-added products in the market through the association of the production methods with the provision of public goods, such as distinctive landscapes.

Different types of socio-economic benefits typically interact with one another and cannot be seen in isolation. For example, the development of added value products in concert with the opportunities for tourism and leisure, often serve to increase the quality of the experience of visitors, leading to ever greater returns to local businesses. These second order benefits highlight the importance of maintaining and enhancing the environment not only for its intrinsic value, but also for the potential that it plays in stimulating economic activity, thereby enhancing the quality of life and vitality in certain rural areas and more broadly.

This chapter examines evidence of the occurrence and magnitude of socio-economic benefits arising from the production and maintenance of public goods through agriculture in the EU, and includes examples from the literature and from the eight case studies carried out for the study. Empirical evidence quantifying these benefits, appears to be limited, however, although there are many more studies in which these benefits are simply asserted, without any specific evidence being offered.

6.2 Tourism and Recreation Depend on Certain Public Goods

The benefits of agricultural landscapes, in particular, and the broader environment, for rural tourism are highlighted in numerous studies from different parts of Europe. There is evidence from many visitor surveys that the perceived quality of landscapes, biodiversity and the rural environment, particularly in mountainous areas, nature or national parks and other scenic landscapes, is the main motivation for visiting the region. Many of these characteristics rely upon the presence of public goods that are created and sustained by farming activity.

Box 6.1, for example, highlights the way in which the rural tourism sector has been built around the traditional agricultural landscapes in Romania. In the Czech Republic, a study comparing intensive and extensive systems found that the farms providing agri-tourism were mostly situated in regions with extensive agricultural systems (Grega *et al.,* 2003). A study conducted in central France indicated that landscape diversity attracted visitors and provided a basis for green tourism (Fromageot *et al.,* 2007), supported by similar findings in the Netherlands, (Vanslembrouck and Van Huylenbroeck, 2003). In the Italian Alps, a study explored the links between tourism and the mountain pastures, with the alpine landscape in the regions of Valle d'Aosta, Piemonte, Lombardia, Friuli Venezia Giulia, Veneto, Trentino Alto Adige inspiring a number of tourism initiatives (Corti, 2004).

In Italy, eco-tourism in the Friuli Venezia Giulia and Veneto regions has played a significant role in economic development, contributing to the ongoing rural vitality of agriculturally marginal areas and providing recreational and cultural benefits to the inhabitants of highly populated areas on the Veneto and Friuli plain (Tempesta *et al.,* 2002). In Germany, the popularity of landscapes of high biodiversity value as tourist destinations has enabled the Rhönschaf – a rare breed of sheep from the Rhön area – to be brought back from the brink of extinction. This breed has become a tourist and culinary trademark of the Rhön as well as enhancing local cultural identity and as a result, sheep numbers have increased significantly (Nyenhuis *et al*., 2007).

There appear to have been few attempts to quantify the strength of this relationship in economic terms, however, although estimates of the landscape's economic impact on tourism tend to emanate from the UK. For example, the Countryside Agency (2002) estimated that rural tourism in the English countryside is worth nearly £14 billion a year and supports 380,000 jobs. As the fifth most popular recreation and leisure activity in Britain, total expenditure on countryside sports is estimated to exceed £3.8 billion per annum and is estimated to support direct employment equivalent to 60,150 full time jobs in Great Britain (Countryside Alliance, 2002). A National Trust study (1999, reported in Winter and Rushbrook, 2003) estimated that 3.7 million (79 per cent) of all annual holiday trips to Devon were motivated by the 'conserved landscape' (defined as fields, wood, moorland, villages and coastline). These visits were estimated to generate a visitor spend of £749 million, and support a total of 23,900 full time equivalent jobs, of which 16,000 are supported directly by landscape motivated holiday trips.

In addition, research in the east of England demonstrated that the growth in the number of short-break holidays to the countryside was largely due to the quality of the natural environment. In 1997, 1.6 million visitor trips contributed £3.4 billion to the region's economy and attractive landscapes generated £35,000 a year from cycle hire alone (RSPB, 2001). The use of water resources is also an important part of the region's economy, and the Environment Agency estimated that more than £500 million a year is spent on boating, angling and other water-based recreation, all of which are reliant on good water quality, which in turn is dependent on good farming practices.

Box 6.1 Rural culture and tourism depend on pastoral agricultural landscapes in southern Transylvania, Romania

The traditional, agricultural landscapes of Southern Transylvania are widely considered to be exceptional in Europe. According to Lennartsson and Helldin (2007), "their biodiversity and cultural remains are outstanding in an international comparison" with specific regions ... providing "a tantalising glimpse of genuine medieval countryside … a landscape that Europe has mostly lost, where a wealth of plants and animals thrives alongside traditional agriculture" (Akeroyd, 2006).

Photographs: ADEPT Foundation (Andrew Jones), Romania ADEPT Foundation (Min Wood), Romania

The economic benefits associated with the development of various forms of tourism are an important second order effect of the public goods provided by subsistence/semi-subsistence small-holdings in Southern Transylvania. However, there is currently little information available to substantiate or quantify these benefits.

The potential for developing rural and agro-tourism in Transylvania, with linkages to other variants such as eco-tourism and cultural tourism, has been identified by numerous authors (Bordanc and Turnock, 1997; Turnock, 2006; Hasund and Helldin, 2007; Baciu *et al.*, 2007). The *National Strategy Plan for Rural Development 2007-2013 for Romania* clearly identifies that "Rural tourism and agro-tourism are potential alternative activities which will continue to develop in rural areas due to the unique landscapes, large semi-natural areas, the hospitability of rural inhabitants, tradition, conservation and the diversity of rural tourist resources" (MAFRD, 2007a).

Farmers were first encouraged to begin diversifying into rural tourism during the early 1990s with the Ministry of Tourism suggesting a range of criteria for the identification of so-called "tourist villages" where support should be targeted (Turnock, 2006). These criteria included "picturesque and non-polluted countryside", "traditional culture" (with regard to costume, handicrafts, literature and music) along with "special architectural styles in areas where villages with traditional rural occupations were still intact" and "attractive natural landscape along with cultural and historical objectives that could form the basis of tourist itineraries".

The current level of development of rural tourism is still relatively limited, but is growing. One commonly quoted (albeit rather limited) indicator is the number of rural "guest houses" (*pensuine*). According to MAFRD (2007b), in 1996, there were only 61 rural guest houses in Romania with an accommodation capacity of 332 bed places. By 2005, this number had increased to 956 guest houses with an accommodation capacity of 11,151 bed places. Accommodation capacity is further increased with investment support for tourist accommodation under the 2000-2006 SAPARD programme which led to the construction of an additional 727 rural guest houses and the creation of approximately 13,000 bed places.

Finally, whilst the growth of rural tourism in Southern Transylvania is clearly linked to the natural beauty, traditional agricultural landscapes and cultural heritage, specific reference should also be made to the rich variety of traditional and locally-distinctive food products (Akeroyd, 2006). These include cheeses, cured meats and various preserves made from fruits and vegetables provided by the pastoralism and small-scale subsistence/semi-subsistence agriculture that is characteristic of the region. These artisan food products involve the careful processing and crafting by hand of local ingredients using natural processes and techniques. This results in unique products with a flavour, quality and character which forms an important part of the rich cultural heritage of the region (Redman, 2009, case study report prepared for this study).

Photograph: ADEPT Foundation (Mihai Cazan), Romania

6.3 Employment Opportunities Resulting from the Provision of Public Goods

A number of studies have sought to provide estimates of the employment effect of the management needed to provide environmental public goods. The figures available are not always limited to those management activities required to provide public goods, however, they do serve to indicate the large sums of money that are involved in activities surrounding environmental management. For example, the nature and landscape conservation sector is estimated to contribute £223 million per annum to England's GDP. Full time equivalent (FTE) jobs in the 'natural environment sector'[19] in England rose from 7,666 to 8,790 FTE between 1991 - 1992 and 2000, and this has been attributed to a growth in direct employment in nature and landscape conservation (GHK Consulting and GFA-RACE, 2004). Meanwhile, estimates indicate that there were approximately 8,000 jobs related directly to the protection of the environment in Scotland in the late 1990s, with approximately 2,600 of these located in rural communities (Broom *et al.*, 1999). Due to the fact that nature and landscape conservation activities additionally involve large numbers of volunteers, this can also contribute to improvements in health, community development, social inclusion and the development of skills (GHK Consulting and GFA-RACE, 2004).

[19] Jobs devoted to the protection, enhancement, management and interpretation of natural habitats and landscape, and related survey, monitoring, environmental education and consultancy work.

In certain cases, the activities necessary for maintaining and enhancing the provision of public goods generate additional employment opportunities to the farm household and to contractors (see Box 6.2 for specific examples). For example, traditional field boundaries or other landscape features often continue to be maintained by farmers either for personal enjoyment an attachment to the cultural landscape, or because they are paid to do so. These kinds of activities are typically stimulated by policies supporting 'non-productive investments' on farms, often as part of agri-environment schemes, where these investments have environmental and socio-cultural value. In this situation, the maintenance work provides employment for the farmer or contractor and to suppliers of the necessary materials, equipment and machinery as well as encouraging the retention of traditional skills. Such payments, therefore, can generate significant multiplier effects within the wider rural economy.

Agri-environment schemes in the UK (England and Wales) have been shown to have positive income and employment effects for the local economy (Harrison-Mayfield *et al*., 1998; Agra CEAS, 2005). In England, the impacts of the pilot Countryside Stewardship scheme on incomes and employment were analysed, both in the rural areas where the agri-environment contracts were operating, and in the wider economy. The study concluded that the scheme, which supported environmental planning, wall restoration, hedgerow planting and management, sowing of wildflower field margins, and pond creation, etc, had a marked positive effect upon incomes and employment among local contractors and farm-related secondary businesses in rural areas as a result of 'the capital works effect'. However, impacts were more negative for selected other businesses up and downstream as a result of the 'extensification effect', due to a general reduction in the intensity of input use and a concomitant decrease in outputs.

In Wales, the basic level agri-environment scheme, Tir Gofal, has been shown to result in increased labour requirements per farm, amounting to 66 additional person-days per farm per year, on average, of which 55.4 additional person-days are attributed to labour required for capital works. Almost half of the extra work generated is carried out by contractors, with 42 per cent carried out by the farmer and their family. Incorporating indirect effects, the impact of the £11.29 million paid to farmers under Tir Gofal on the local economy amounted to £6.3 million in 2003, associated with approximately 112 FTE jobs. Its impact on the Welsh economy over four years was estimated to be over £21 million, supporting some 385 FTEs.

Although environmental management activities can provide socio-economic benefits in the wider rural economy, the extent to which farmers themselves benefit economically from the provision of public goods can be variable. A study in the Haute-Vienne in France (Vollet and Guérin, 2005) analysed the financial flows in terms of job creation and expenditure on materials and services arising from the maintenance and creation of the landscape in the "Pays des

Météorites". It calculated the money spent, the jobs created directly and the financial returns to other businesses from using the landscape. The study found that farmers contributed 57 per cent (about €750,000) of the total money spent to maintain the landscape. In spite of this significant contribution, farmers did not receive any financial returns from the subsequent use of the landscape and all of the 25 jobs created were in the service sector.

Box 6.2 Socio-economic benefits depend on the management of landscape features.

Lake District National Park, UK.
Photographs: K. Hart.

Foothills of Mont Blanc
V. Swales.

A number of studies have investigated the second order economic benefits arising from the maintenance of a particular landscape feature. For example, Mills *et al.,* 2000 (reported in Winter and Rushbrook, 2003) estimated the additional income and employment impacts to the local economy arising from a hedge restoration project in Devon, with expenditure of £1 million per year, over the course of five years. Over the 5 year period this contributed both directly and indirectly to income generation within the local economy, producing a net additional output of £2,439,732. Greatest income impacts were on wages to contractors and farmers who undertook the work. Spending of these wages in the local economy also had a significant impact, generating a further £158,662, and which resulted in an overall expenditure multiplier of 1.3.

Dry stonewalling, UK
Photographs: Candace Brown, Welsh Assembly Government

Hedging, UK
Countryside Council for Wales.

A study of grant-funded traditional dry-stone wall and farm building restoration on farms in the Yorkshire Dales National Park, UK, found that walling repairs were particularly beneficial to the local economy, with an income multiplier of 1.65, and an equivalent multiplier effect of

1.92 for new walling schemes (Courtney *et al.,* 2007). These multiplier values were due to the fact that farmers source a high proportion of their walling contractors locally. It was also estimated that grant maintained barns and walls may contribute £2.44 million indirectly to the local economy per annum through increased spending on the part of tourists. Income effects on the wider local economy are likely to have been substantial, equivalent to £3.46m - £5.41m, over a 6 year period. With regard to the employment effect, the restoration schemes created a minimum of 18.6 FTE jobs through building projects and 19.0 FTE through walling repairs.

Certain farming systems, in particular, traditional orchards and permanent crops, extensive grassland and some small scale arable or mixed systems, typically employ relatively labour-intensive methods, contributing to rural jobs and skills. For example, a number of studies have examined the social and economic effects of extensive olive production in Andalusia, Spain (Viladomiu and Rosell, 2004) a system of production which supports the provision of public goods (Guzmán Álvarez, 2004). Employment generation is the most important effect, although labour demand varies according to the system of cultivation. In terms of employment per cultivated area, high output groves have the greatest labour requirements (25.3 person days per hectare), compared to average agricultural land in inland Andalusia (for example, cereal production labour requirement is less than 4 person days per hectare). Analysis shows the importance of this crop in social terms, taking into account that a) generated employment involves 37.4 per cent of total agricultural employment in Andalusia rising to almost 100 per cent in the main productive areas, b) Andalusia is a convergence region, where average personal income is below 70 per cent of EU average, and c) agriculture continues to be a major source of employment in the region (8.2 per cent of total employment, compared to 3.7 per cent in EU-15 Member States). However, a major drawback of the employment generated by the olive sector is that it is heavily concentrated in the olive harvest season (December-March).

6.3.1 Social and Cultural Benefits Associated With Public Goods

In addition to the second order social and economic benefits that arise from the provision of public goods by agriculture, a range of other aesthetic, spiritual, psychological and other nonmaterial benefits are experienced through contact with the environment. The customs and culture associated with those farming systems that provide public goods are often highly valued by local people as they help to sustain social capital and strengthen the ‘sense of place’ or local pride in culture.

In Romania, the traditional, agricultural landscape of Southern Transylvania is not only of exceptionally high value for nature conservation, but is also a cultural landscape and the direct legacy of a long history of pastoral management and cultural inheritance. This cultural heritage is particularly associated with the utilisation of semi-natural grasslands for sheep production, with the roots of many traditions, songs, foods and words derive from traditional pastoralism. For example, the national poem of Romania, *Miorița* (The Little Ewe), is about shepherds and is considered to be one of the most important pieces of Romanian folklore. According to Husar and Latham (1999), "*Miorița* may fairly be described as the great, defining ballad of the Romanian personality and culture. Thus, it ranks in Romanian self-consciousness with the

Iliad and the Odyssey for the Greeks [*and others*] ….. All of these works provide their respective nationalities with items of national identity, common symbols that echo through the national culture, common ideals which inspire and shape the national personality, a common world view which in time infects the national approach to philosophy, religion and, not infrequently, history and politics".

6.4 Exploiting the Market Opportunities of Environmentally Sustainable Food Products

The products of certain environmentally sustainable farming systems have the potential to be differentiated on the basis of their association with particular production methods or settings and, on this basis, to attract a premium price. Added value products can act in concert with other second order economic activities like tourism to increase the quality of the visitor experience, potentially leading to greater economic returns to local businesses.

Certain farmers are able to differentiate their products on the basis of the association of particular production methods with the provision of public goods, such as landscape or maintaining the habitat of farmland species. This association enables these farmers to access a premium price for their product, thereby contributing to the ongoing economic viability of the farm business. Adding value to products in this way can be achieved through developing product certification and labelling schemes, assurance schemes, green procurement, and ensuring that the benefits are effectively marketed and communicated to the public, for example, through advertising and promotional campaigns.

The potential economic benefits of such approaches are well recognised, and the success of organic certification demonstrates how successful such approaches can be. Multiple private certification schemes already exist in the EU which are voluntary for farmers and require participants to meet a range of standards in relation to the environment, food safety and animal welfare. In return, the farmer can enter certain supply chains and sometimes receive a higher premium for their product. There are many examples from the case study countries of where a price premium has been achieved for products marketed on the environmental credentials of the production systems and/or the landscape from which they emanate. These are set out in Box 6.3 alongside some of the environmental and socio-cultural benefits associated with the creation of these 'added value' products.

Box 6.3 Examples of products marketed on their association with environmentally beneficial production methods

In Andalucia, **Spain**, there are 14 Denomination of Origins (DOs) for olive oil covering 780,000 hectares and 51 per cent of the area under olive production. Created in the 1990s, the aim was to generate added value for the olive products of these areas through differentiation based on the extensive character of mountain olive groves, many of which are located in natural parks and in areas where traditional olives on low slopes predominate. The DOs conduct quality verification and encourage more environmental friendly production practices such as integrated production (Mercasa, 2009).

In Andalucia, **Spain**, in the area of Baeza (Jaén) two types of speciality olive oil are marketed, one from olives grown in areas where terraces have been maintained, and the other from trees that are more than 100 years old. The price for both speciality products reflects the more expensive cultivation of these trees as well as their lower productivity, and is three times greater than that for other olive oils produced from the same mill.

In **France**, producers formed an *Association des fromages d'Auvergne* for the five main cheese PDOs (Bleu d'Auvergne, Cantal, Fourme d'Ambert, Saint Nectaire, Salers) and set up the "Route des fromages" network - comprising farms, dairies and cheese makers along a tourist route. There is a significant price difference per cheese between members of the network (average price of €14.99) and non-members (average price of €12.79) (Vollet *et al*., 2008). When purchasing the cheese, consumers showed a preference for the typical landscape of the St Nectaire production area (altitude, plateau, open-space, typical farms, hedges, woods), leading the researchers to conclude that grazing practices in mountainous regions are a unique selling point for promoting cheeses to consumers (see also Réviron *et al.,* 2008).

Corti (2003) interviewed visitors to the Italian Alps. The study found a positive relationship between the purchasing motivations of consumers of "formaggio d'alpeggio" (mountain pasture cheese) and the traditional production system it is related to. Many interviewees purchased cheese directly from mountain farms, and were aware of the importance of mountain pasture for the diet of the dairy cows.

In Veneto, **Italy**, the Plasmon "green oases" is a specialised children's food production business that has established contracts with farmers to farm with a lower impact on the environment. They produce apples and pears that are used in the production of fruit products for children. Another Italian initiative, "zero kilometres", is a network of farms, coordinated through a website (www.farmersmarket.it) and supported by a farm organisation (Coldiretti) that organises the direct sale of products at the local level so that food does not travel, contributing to pollution reduction and energy waste control. An increasing number of farms are joining the network all over Italy (Italian case study).

In the **UK** the LEAF (Linking Environment and Food) Marque, is a whole-farm assurance scheme that gives market-place recognition to high standards of production, including environmental and animal welfare standards. With 430 members, all UK grown, non-organic fresh fruit and vegetables sold through one of the UK's main supermarkets is LEAF Marque produce, equivalent to 18% of the UK total. 2.5% of UK agricultural cropped land is now covered by LEAF Marque (UK case study).

In Baden-Württemberg **Germany,** an association of farmers, mills and bakeries (Marktgemeinschaft KraichgauKorn e.V.) has formed to market cereals produced without the use of pesticides, thereby reducing contamination of the soil and groundwater as well as biodiversity by maintaining habitat for wildlife species. In the valleys of Enz and Simonswald in the Black Forest, farmers founded a producers' initiative "ZweiTälerLand" (land of the two valleys) in 2001 to produce and promote beef from suckler cows grazed on extensively grazed species-rich pasture (German case study).

Despite the range of examples that exist, there are little data available on the economic value of products marketed on their environmental attributes. In England, a report for Defra (GHK Consulting and GFA-RACE, 2004) noted that a market premium of 8 – 12 per cent could be achieved, particularly when the goods are marketed at a local 'niche' level, rather than in the mainstream market. An attempt to value the 'economic significance of environmentally based consumer food and drink production', calculated a total market value of approximately £2.7 billion for organic, environmentally marketed and local produce in England, although these figures should be treated with some caution given the broad assumptions on which they were based.

Not all farmers providing public goods, however, are able to exploit these potential market opportunities. Given the economic fragility of many extensively grazed livestock farms, which are responsible for maintaining wide swathes of attractive agricultural landscapes, the development of such added value products is often not an option. Financial support is needed to help cover start up costs, along with investment grants to buy the machinery and equipment needed for products to meet the requisite EU rules and regulations, particularly EU hygiene standards. A number of Axis 1 measures within rural development policy provide support for the development, processing and marketing of added value products as well as support for the costs incurred for cooperation between producers and processors.

For some products, appropriate legislation is also a necessary condition for the development of added value products. For example, Council Regulation 510/2006 on geographical indications and designations of origin helps to protect producers against counterfeiting and the maintenance of a high level of product quality. However, an examination of several PDO certificated products in Spain showed that these labels are concerned predominantly with product quality rather than environmental quality. In terms of farming practices, production rules are vague, and products carrying the PDO label can be from farms with different practices and environmental conditions, for example the 'dehesa de Extremadura' ham (Beaufoy, 2007). The recent Green Paper from the European Commission on agricultural product quality - product standards, farming requirements and quality schemes (COM(2008) 641 final) introduced the idea of a certification scheme for those farming within High Nature Value farming systems, which could go some way towards providing an EU-wide certification scheme based on environmental quality if appropriate criteria could be established.

There are some examples of where the provision of public goods by agriculture leads to socio-economic benefits which are themselves mutually reinforcing. For example, the construction of a new organic dairy in Germany (the Rhöngold dairy) which was set up to encourage the conversion of several farms to organic production, quickly expanded into a much broader suite of inter-related rural development activities, including nature conservation, region-specific products and rural or green tourism in response to local demand. This has served to establish linkages between the provision of public goods at the farm level and the broader rural economy as well as the communities who live there (van Der Ploeg *et al.,* 2000). Similarly, research in Scotland found that natural heritage 'reliant' firms (such as tourism, recreation and manufacturing), whose activities are dependent on the quality of the environment and natural heritage for economic success - often maintained through agriculture - are able to stimulate local economic growth through sales of goods and services to visitors. In turn, this helps to generate income and employment multipliers through the retention of income due to local sourcing (Courtney *et al.,* 2006).

The demand for local products that are associated with agricultural landscapes is also illustrated by examples in Italy, where surveys have shown that tourists are attracted not only by cultural landscapes, but also by the quality and authenticity of the products with which these landscapes are associated. For example, several studies have emphasised the role of the Italian wine sector, and particularly the establishment of 'wine routes' and 'Designations of Origin' contributing to the creation of new job opportunities and an increase in revenue for wine farms (Gatti and Incerti, 1997; Gatti, 2001). Although these studies make no explicit link to the provision of public goods, the relationship is implicit because all the wine routes are promoted to tourists on the basis of the beauty of these cultural landscapes. The development of Brunello di Montalcino wine provides a good example of the attraction to tourists of a high quality product and its association with cultural landscapes, rural traditions and customs (Mattiacci and Zampi, 2004). With a population of about five thousand people, and one of the highest numbers of elderly people in this part of Italy, it is estimated that for the year 2000 alone, nearly one million tourists visited the town, with significant benefits to the local economy.

6.5 Conclusions

In addition to the inherent value of public goods to society, a range of second order social and economic benefits occur that depend, partly or wholly, on the existence of the public goods provided through agriculture. These second order benefits highlight the importance of maintaining and enhancing the environment not only for its intrinsic value, but also for the potential that it plays in stimulating economic activity, thereby enhancing the quality of life and vitality in certain rural areas and more broadly. While many of these relationships are documented through case studies, evidence of quantified economic impacts is lacking in many parts of Europe. More precise evidence based on sustainable research would be helpful to fill the gap. The development of indicators to measure the social benefits associated with the underlying agricultural activities as well as those generated from the public goods themselves would also be valuable.

The relationship between environmental assets and economic development is not always in harmony. Often, economic development competes with environmental outcomes for the use of scarce factors of production. There is evidence from the Romanian case study, for example, to suggest that whilst there is a growing recognition of the opportunities for tourism that the attractive landscapes in southern Transylvania provide, certain investments have damaged the environment, with the potential to degrade the very resource upon which economic development rests. The challenge of securing stewardship of this array of environmental, social and cultural assets in particular rural localities is to ensure that economic development unfurls in an environmentally sustainable manner. There appears to be a need not only for policy to encourage the provision of environmental public goods, but also for the policy framework to be sufficiently integrated to ensure that where social and economic synergies occur, they are promoted.

7 DEVELOPING OTHER APPROACHES TO DELIVERY

7.1 Introduction

Chapter 5 examines the policy support measures used at the present time to ensure the provision of the main environmental public goods associated with agriculture. It was concluded that the size of the budget currently available under EAFRD, and specifically the proportion allocated to those measures that are critical in securing the provision of public goods, appears insufficient to achieve EU environmental targets in line with societal demand. As such, there is an ever-increasing need to improve the cost effectiveness of policy measures as well as to enhance the environmental outcomes delivered to secure larger cost-benefit gains. This chapter examines some of the alternative approaches to the delivery of public goods that have been piloted and used within Europe and further afield, with a focus on those that seek to improve the cost effectiveness of existing policy measures, setting out both the opportunities and limitations associated with their use.

The chapter begins with an examination of a range of approaches being used or trialled to improve the cost effectiveness and environmental delivery of existing policy measures, such as the agri-environment measure and cross compliance. Second, it reviews a range of more market based instruments to encourage the delivery of public goods which may complement conventional incentive measures, drawing on examples from non-EU countries.

7.2 Improving the Cost Effectiveness and Environmental Delivery of Existing Policy Measures

This section examines a range of approaches that are either currently in use or are being piloted to improve the cost effectiveness and environmental outcomes from existing policy measures. The focus is on two policy specific policy measures – cross compliance and the agri-environment measure.

Cross compliance links the full receipt of decoupled direct payments to compliance with a set of regulations and standards to keep the land in good agricultural and environmental condition. There is an active debate on the merits of strengthening cross compliance, which could afford a means of achieving improved environmental outcomes over a broad extent of agricultural land. The agri-environment measure has been shown to be particularly important for securing the delivery of a whole range of public goods, on account of its explicit objectives and precise targeting. There has been particular interest, particularly amongst the more northern Member States, such as Germany, the Netherlands and the UK, in enhancing the cost effectiveness of their agri-environment schemes and the delivery of environmental outcomes. The approaches explored include, for example, 'payment by results' (PBR) schemes and the use of auctions delivery. As discussed in Chapter 1, however, the use of some of these more market inspired instruments may provide a means of stimulating competition amongst suppliers, but are appropriate only within the context of a policy framework with clear targets and where the administrative capacity exists to monitor, verify and enforce outcomes. The requirement for farm advice and training may be greater too.

7.2.1 Outcome Based Approaches

Traditionally, agri-environment schemes have been designed to meet environmental objectives through prescribing and paying for a set of management practices that have been demonstrated to deliver environmental benefits, rather than making payments conditional on achieving the environmental outcomes themselves. This prescription-based approach is a pragmatic response to the administrative and monitoring challenges associated with assessing the successful delivery of a wide range of environmental outcomes (Schwarz *et al.*, 2008). However, it has been argued that outcome-oriented measures may provide a more cost effective way of delivering public goods, by making payments contingent on achieving certain results, for example, the total quantity of Nitrogen-loss avoided, or the number of wild plant or bird species maintained or increased. Such schemes, however, need to be accompanied by suitable packages of advice and training for farmers.

Outcome oriented measures, sometimes known as PBR schemes, directly reward the desired result without imposing specific management prescriptions, thereby giving farmers the flexibility to choose the most cost effective options whilst taking into account the specific characteristics of the site. This may provide farmers with an incentive to seek out new methods of reducing costs, to introduce innovative approaches, or to take risks in seeking to provide such benefits (Schwarz *et al.*, 2008). Greater responsibility for the outcomes can also mean that farmers engage more with what they are trying to achieve (Güthler and Oppermann, 2005). If indicators can be developed that are sufficiently precise to measure the outcomes achieved in specific context, then this can also improve the controllability of measures, compared to action-oriented prescriptions such as 'time of cutting of grass' or 'amount of fertiliser inputs', which are difficult to measure and have been criticised by the European Court of Auditors (ECA, 2005).

However, such approaches carry a number of limitations and are not appropriate for delivering all environmental outcomes, particularly where precise outcomes are less easy to identify, or in those cases where widespread action is required across the farmed landscape. A recent review of such schemes (Schwarz *et al.*, 2008), stressed that 'the most significant role for PBR schemes may be as additional agri-environment support targeting local environmental issues in specific areas', and as such, this type of approach is particularly suited to achieving biodiversity outcomes.

Even when applied in more targeted situations, the risks to farmers may be prohibitively high, and certainly are often greater than in the case of prescription-based approaches. Typically, environmental outcomes are the result of complex biophysical interactions which require specific combinations of management practices in a given locale. The outcome of a particular form of management may be affected by a range of external factors, influenced by the weather, the actions of neighbours, or by an infestation of pests, for example, and thus is often not entirely within the control of a land manager. The final desired outcome - such as regeneration of semi-natural vegetation - may also take many years or even decades to appear. To address the issues of risk and uncertainty, Schwarz *et al.,* (2008) suggest that payments may need to incorporate a risk premium or perhaps be split between a guaranteed payment for participation plus a bonus on delivering the desired outcome. This is the case in the Baden-Württemberg example described in Box 7.1, where the outcome-based measure is offered as a top-up to an action-oriented basic measure with a fixed payment.

The trialling of these types of approaches has prompted much discussion about the availability of indicators that are sufficiently precise to assess the outcomes achieved, in turn informing subsequent management decisions. Given the complex relationship between land management and environmental outcomes, and the often considerable time lag before the impacts are clear, indicators need to capture the causal link between the actions of farmers and what they are being asked to achieve, be sufficiently precise and often site or regionally-specific. For example, an indicator measuring plant species flowering within a set time frame may be used to assess the presence of species-rich grassland, as they are easy to identify, and their presence or absence is directly linked to the management activities of the farmer to a large extent. Another example could be the measured surplus of soil mineral Nitrogen in autumn or the number of nests of ground nesting birds in a given area. It is more difficult to measure improvements in soil functionality or the suitability of habitat for migratory birds where the populations are affected by factors elsewhere in the migratory cycle. Equally it can be difficult to measure the contribution of individual farms to an outcome such as lower pesticide residues in groundwater.

The challenge for outcome-oriented schemes is to find an alternative, and more accurate means of setting a price for the environmental outcome, that reflects the full costs of its provision and yet still remains a cost effective means of delivery. In the meantime, those outcome oriented schemes operating at the present time tend to calculate payments based on income foregone and the additional costs of those management practices that are assumed to be required to deliver the outcome needed.

There are a number of outcome-oriented schemes that are currently in operation, implemented at a local or regional scale, certain of which are still in a pilot phase. Many have a particular focus on grassland habitats and plant species, with some examples focusing on specific animals and bird species. Two examples set out in Box 7.1 owe their success to the precise nature of the desired outcome alongside the existence of precise indicators and effective monitoring and control.

Box 7.1 Outcome-oriented schemes in the Netherlands and Germany (Baden-Württemberg)

Meadow Birds Agreement, Netherlands: This agri-environment scheme aims to reverse declines in breeding wader populations by reducing disturbance during the breeding season through postponed mowing of grassland areas, and to improve hatching and chick-rearing conditions through a 'payment by clutch' option. It is implemented through a cooperative approach rather than at the level of the individual farmer. Collective packages require that 10 - 20 per cent of entered land is subject to the delayed mowing scheme. The minimum eligible area for a collective package is 100 hectares. Under the payments-by-clutch option, farmers are paid according to the number of clutches on their land, as monitored by the farmers themselves or by volunteers. The Meadow Birds Agreements is currently implemented on 150,000 hectares of land and the Dutch government aim to secure the entry of a further 100,000 hectares by 2010 (Schwarz *et al.,* 2008).

Baden-Württemberg Grassland Scheme: This scheme was first developed for the support period 2000-2006 by a grassland expert and nature conservation consultant as a top-up payment of 50€ in addition to an action-oriented grassland payment of 90€. In 2004, 65,200 hectares (12 per cent of grassland in Baden-Württemberg) were under agreement. Since 2005, this approach has been co-financed nationally and has been taken over by other German Lander with regional adaptations.

The result indicator is the presence of at least 4 indicator species for extensive grassland (out of a total list of 28). Farmers are free to determine how to manage the species-rich land with respect to cutting time, stocking density and fertiliser use. However, due to the fact that payment calculations are derived on the basis of income foregone and the additional costs of undertaking certain actions, certain prescriptions were also introduced, including documentation of fertiliser application and time of cutting, a ban on area-wide use of pesticides, a ban on silage production on the agreement area and on grassland conversion at the farm level.

Alongside the control bodies, farmers are responsible for assessing the presence of plant species on the contract area, by conducting transects on each plot to record indicator species during early summer. The outcomes are therefore fairly simple to control. This has significantly increased their knowledge about plant species (Osterburg and Runge, 2006).

7.2.2 Discretionary Agri-Environment Schemes

Improving both environmental delivery and the cost effectiveness of schemes can also be achieved through the application of a discretionary approach to entry to agri-environment schemes. Under this approach only a proportion of farmers applying - namely those offering the highest level of environmental benefit or added value - are offered agreements. This compares to a majority of schemes which are universally available to all relevant farmers so long as management prescriptions are adhered to. Under this approach, payment rates for management options are pre-set and farmers must propose a programme of management across the farm that delivers sufficient added value for the environment to compete against other applications for limited funds.

To be effective, discretionary agri-environment schemes require a clear definition of criteria and priorities against which applications are scored which means that the potential to achieve more targeted and specific outcomes is higher. As a result, however, discretionary schemes do incur higher transaction costs, both for public administrations and for land managers, than universally available schemes.

This approach has been applied in the UK (England) since 1994 when it was introduced under the pilot Countryside Stewardship Scheme, and it continues to be used under Higher Level Stewardship (HLS). Under this scheme, guidance is published on the environmental priorities for HLS within 110 separate target areas, covering roughly a third of England (Natural England, 2009). Within these target areas, those agreements that make the greatest total contribution to the identified environmental priorities are prioritised. This discretionary scheme operates alongside Entry Level Stewardship which is available to all who meet the entry requirements.

7.2.3 Auctions

An alternative approach to increase the cost effectiveness of agri-environment schemes, and one that has started to receive increased attention, is the auctioning of agri-environmental contracts (Glebe, 2007). While the possibility to select beneficiaries for entry into agri-environment schemes on the basis of calls for tender is explicitly mentioned in the current rural development policy (Article 39(4)), only few pilot programmes for auctions exist in the EU at the present time. Auctions are far more common in the United States and Australia, a prominent example of which is the US Conservation Reserve Program (CRP) – see Box 7.2.

Through competitive bidding for a limited number of contracts, farmers offer the lowest rational price. The theory is that auctions will achieve a high benefit-cost relationship which reduces public expenditure in relation to the desired outcomes (Wätzold and Schwerdtner, 2005). Auctions have the potential, therefore, to either achieve the same level of scheme uptake at a lower total cost, or to expand uptake within a given budget (Latacz-Lohmann and Schilizzi, 2007). Auctions should also help to increase the targeting of agreements to locations where the highest benefit-cost relationship can be expected (Schwarz *et al.*, 2008).

In practice, however, auctions do not always lead to cost savings, nor are they appropriate in all circumstances. For example, auctions are likely to involve high administrative effort for both governments and farmers (Holm-Müller *et al*, 2002; Gerowitt *et al,* 2006; OECD, 2007b), with unsuccessful bids as well as successful bids incurring transaction costs for both farmers and the administration (Glebe, 2007). The potential of auctions can also be diminished by the strategic behaviour of farmers and as a result of information becoming available on bid caps (Schwarz *et al.,* 2008). If the highest acceptable bid is announced, or the average acceptable bid published, this can reduce the cost effectiveness of auctions, especially in the case of repeated auctions, as farmers adapt their offer to these prices (Latacz-Lohmann and Schilizzi, 2005). Such experiences have been reported for the CRP in the US (Claassen *et al*., 2008).

The cost effectiveness of auctions may also be limited for other reasons. For example, if only a small number of farms are likely to take part in the bidding, or where there are high uptake targets and practically no bids are refused, low levels of competition reduce its cost-effectiveness. As such, an auction system for selecting competitive bids for management of small scale, local environmental goods is not appropriate, due to a lack of competition and the specificity of the services needed (Güthler and Oppermann, 2005; Wätzold and Schwerdtner, 2005; OECD, 2007a). On the other hand, if an auction attracts a high number of applicants and many have to be rejected, this might impact negatively on farmers' willingness to apply in the future (Cattanneo *et al.*, 2005). In such situations, fixed-rate payments or individually negotiated contracts and grants are likely to be a more cost effective way of achieving the outcomes required.

Box 7.2 Examples of the use of auctions in the United States and Australia

The US Conservation Reserve Program (CRP): The CRP, established under the 1985 Farm Bill, encourages farmers to retire highly erodible cropland or other environmentally sensitive land. The area covered is equal to approximately 10 per cent of U.S. cropland (Claassen *et al*., 2008).

Contracts are granted following competitive bidding by farmers and are for a period of 5 – 10 years, with payments administered on an annual basis. The CRP uses a detailed targeting instrument - the Environmental Benefits Index - which assesses the environmental goods and services expected from ceasing production on a certain plot. Objectives are weighted, with equal weighting given to benefits to wildlife, water quality and soil protection (Baylis *et al*., 2008). Farmers wishing to participate offer bids that specify the land in question, the land management that would be established, and the level of financial assistance that would be required.

The cut off level of bid scores is selected after all bids have been received (Claassen *et al*., 2008). Highest benefits for least cost are rewarded. The CRP often has more bids than it can afford to fund, and thus farmers are forced to moderate their bids, which avoids excessive windfall profits (Baylis *et al.*, 2008). Opportunity costs are automatically taken into account because farmers are unlikely to submit a bid which is lower than the amount of income forgone plus maintenance costs. This approach has a large information requirement, which includes the establishment of the environmental characteristics of the plots, and detailed information on the benefits produced by any one or a combination of actions.

US Wetlands Reserve Program: The US Department for Agriculture piloted a reverse auction in the Conestoga Watershed as part of the Wetlands Reserve Program in 2006, with respect to the management practices required to reduce phosphorous loss to local waterways (Rollett *et al*., 2008). In this example, many farmers expressed an interest in participating in the scheme and were eager to implement the management practices required, but were excluded from the funding because their bids were not sufficiently competitive.

The BushTender trial, run by the former Victorian Department of Natural Resources and Environment, in 2001/2002, was one of the first projects in **Australia** to implement an auction approach to protect and enhance native vegetation on private land. An index to rank the biodiversity outcomes of different proposals (Biodiversity Benefits Index) was developed and applied.

Under this scheme, landholders submitted competitive tenders, stipulating a price for the management activities they are prepared to offer to better protect and improve native vegetation over and above those required under current obligations and legislation. Bids were compared, and those which offered the best value for money were successful. Successful landholders receive periodic payments for their services under management agreements signed with the Department of Sustainability and Environment. Under the management agreements, landholders report each year on their vegetation management activities and their progress towards the agreed objectives (Department of Sustainability and Environment, 2008). The scheme has been deemed a success, has had high participation rates, and has subsequently led to the development of several other auction based approaches to deliver a range of environmental outcomes.

7.2.4 Integrated and Collaborative Approaches

Many approaches to encourage the provision of public goods tend to take a rather compartmentalised approach towards their delivery, targeting a particular land use or beneficiary. However, it has been increasingly recognised that greater environmental benefits may be accrued if delivery takes place at a broader geographic scale, particularly where a territorial-wide response is required, in relation to improving water quality in a river catchment, or ensuring ecological connectivity at the landscape scale, to facilitate species adaptation to climate change. In addition, the use of a range of policy instruments in combination can help to achieve more effective results. This requires policy measures to be coordinated, but also relies on the cooperation of multiple land managers, and often local communities within the defined geographical area for enhanced environmental benefits.

Cooperative and integrated approaches are more common in the United States than in Europe, with the Delaware County approach to catchment management providing a particularly interesting case (see Box 7.3). However, within Europe, the Netherlands has adopted a co-operative 'landscape scale' approach to delivering agri-environment schemes. Local organisations of farmers and non-farmers work in close collaboration with each other and with local, regional and national agencies to integrate nature management into farming practices. The first environmental cooperative was established in 1992 as a self-help group and now there are about 125 environmental cooperatives in the Netherlands. In 2004, it was estimated that they have almost 10,000 members, including 10 per cent of all farmers and covering 40 per cent of all agricultural land. The approach taken by many to protect their common interest and to resolve conflicts is to allow each member to participate in the projects they support, and to opt-out of others. This flexibility means that only those projects with sufficient support go ahead (IEEP, 2009).

Box 7.3 Examples of cooperative and integrated approaches to deliver public goods

Delaware County Watershed Agreement and Watershed Agricultural Program:
Concerns about water quality in the 1980s led to the introduction of more stringent legislation in the US. Having the largest unfiltered water system in the US, New York City (NYC) aimed to find a means of avoiding the need to implement costly filtration processes. To do so the city authority had to meet a range of criteria in order to receive 'filtration avoidance' from the US Environment Protection Authority (EPA). The approach taken to achieve this involved the establishment of a combination of regulation, advice, land use measures, incentives and voluntary action and is a good example of a collaborative and adaptive approach to catchment management for the protection of rural land and water resources.

Delaware County accounts for about 50 per cent of the New York City watershed. The approach taken comprises three distinct elements:

1) Voluntary agreements with farmers through the Watershed Agriculture Program, promoting the adoption of best management practices by farmers based on advice and whole-farm planning financed from New York City and from other state and federal schemes. Approval is needed from the county Soil and Water Conservation Service and the Watershed Agricultural Council prior to any funding being received.
2) The financing of wider community pollution reduction programmes including funding for new infrastructure for sewage plants, septic systems, sand and salt storages, storm water, stream corridor protection, forestry management, public education, and a fund for environmentally friendly economic development.
3) Land acquisition by New York City within the watershed, with a schedule of priorities for land purchases based on their likely impacts on water quality. As alternatives to outright land purchase it is also possible for the City to purchase development rights in the form of conservation easements, or agricultural easements that place restrictions on agricultural practices while the owners continue occupation.

Since the start of the program in 1994, nearly 85 per cent of the farms within the watershed have signed voluntary farm agreements (about 350 farms) and the success is attributed largely to the effective cooperation between the extension services and local planners, and the full funding of on-farm implementation. As an outcome of this agreement in 1997, the EPA issued a five year Filtration Avoidance Determination (FAD), which has since been extended for a further ten years. (Source: Willett and Porter, 2001; Smith and Porter, 2009)

7.2.5 Strengthening Cross Compliance

Strengthening cross compliance affords another means of achieving environmental outcomes over a broad extent of agricultural land. However in so doing it results in the costs of the actions needed to provide such outcomes falling to the farmer. Cross compliance is a horizontal tool in the current CAP, linking the full receipt of the direct payment by farmers to compliance with a set of rules. As set out under Council Regulations 73/2009, 479/2008 and 1698/2005, beneficiaries of the CAP's direct payments (Single Payment Scheme (SPS), Single Area Payment Scheme (SAPS) and other direct payments), as well as beneficiaries of most area and animal related rural development measures, and certain wine payments, are required to comply with a range of requirements and standards, or risk a reduction to their payments in the event of non-compliance.

The degree to which cross compliance supports the provision of public goods above the regulatory baseline is dependent on the nature of the GAEC standards set at the European national and regional level. An early evaluation of cross compliance showed that, in the majority of Member States, the standards that had been introduced in 2005 were largely either based on pre-existing national legislation or reflected good farming practice that was already broadly complied with in practice (Alliance Environnement, 2007). The rules applying to GAEC have been clarified under Council Regulation 73/2009 and Member States are continuing to introduce new requirements on farmers. Nonetheless, there is an active debate about whether further regulations should be added to the list of SMRs and whether the range of GAEC standards should be extended. Any raising of basic standards, however, necessarily reduces the actions that can be delivered and paid for through voluntary support measures, such as agri-environment schemes, and determining the appropriate balance between mandatory requirements and where farmers require some form of financial remuneration to encourage beneficial actions are central considerations in these debates.

Two Member States have proposed that land managers are to be required to manage a proportion of their land to benefit the environment. As part of its response to the changes in cross compliance introduced under the 2008 CAP Health Check, France is proposing to introduce a requirement on all farmers receiving direct payments to maintain a certain proportion of agricultural land under environmental management, including maintaining grassland, hedgerows, field margins, and groups of trees etc. It is proposed that this will be introduced incrementally with 1 per cent of land managed in this way in 2010, 3 per cent in 2011 and 5 per cent in 2012. Farmers will be required to create such features and habitats, for example, through the conversion of arable land to grassland or by planting hedgerows if they do not have a sufficient proportion at the present time.

In the UK, the Government, in partnership with the farming industry and environmental bodies, has introduced a voluntary approach combined with agri-environment support payments, to retain a proportion of arable land that previously would have been under set-aside as fallow or managed to deliver environmental outcomes. Under this approach, known as the 'Campaign for the Farmed Environment', a number of targets have been set. These include targets to retain the area of uncropped land at 179,000 hectares and to improve the management of at least one third of this land to support habitats for birds, insects and mammals; to encourage 60 per cent of farmers outside agri-environment schemes to undertake voluntary environmental management by 2012; to increase uptake of agri-environment schemes to 70 per cent of English farmland from the current level of 66 per cent; and to double the uptake of the relevant agri-environment measure, the in-field Entry Level Stewardship options (an additional 40,000 hectares). If these targets are not met, then the Government has reserved the right to introduce compulsory measures via cross compliance to ensure that a proportion of all arable land is under some form of environmental management.

One proposal to strengthen cross compliance (although this approach could also be attached to any type of area based payment) is the introduction of a requirement for farmers to keep a percentage of land under environmental management, often referred to as an Ecological Priority Area (EPA) or Ecological Compensation Areas (ECA) (see BirdLife International, 2007; NABU, 2007; FNE, 2007; Schwarz *et al.*, 2008; IfAB, 2009). Many of the suggestions for this type of approach were developed as a proposed means of retaining the environmental benefits of set-aside following its abolition under the 2008 CAP Health Check. This policy measure is already used in Switzerland, where farmers are required to keep seven per cent of their land as 'ecological compensation areas' as a condition of receipt of direct payments (see Box 7.4).

Box 7.4 The Swiss Ökologischer Leistungnachweis (ÖLN) – proof of ecological performance

In Switzerland, the ÖLN is a precondition for the receipt of direct and ecological support payments. It is subject to compliance with relevant environmental legislation.

The ÖLN includes the following requirements for farmers:

- Compliance with animal welfare legislation;
- Stable nutrient balance with a maximum margin of 10 per cent for N and P;
- Adequate share of ecological compensation area (7 per cent of the Utilised Agricultural Area; 3.5 per cent in the case of special crops such as vegetables, fruits or vines);
- Regular crop rotation (breaks between cultivation of the same crops or at least 4 different crops with maximum shares for single crops);
- Soil protection requirements for winter cover. In addition soil erosion may not occur regularly, otherwise suitable measures have to be taken or a soil protection plan applied;
- Targeted use of plant protection products.

In many cases, the requirements of the ÖLN are higher than those in the EU. In particular, the requirements for animal welfare, those concerning nutrient balances and buffer strips, and detailed standards for the use of plant protection products and for ecological compensation go further than those applied in the EU.

A central element of the ÖLN is to maintain, create and increase the ecological value of landscape elements. Farmers have to prove the existence of a certain percentage of ecological compensation area at the farm level (e.g. extensively managed grassland, set-aside land and field strips, hedges or field woods, small water bodies, stone walls, traditional orchards, and natural tracks) and requirements exist for the maintenance and management for these features. If necessary, these areas have to be created or leased additionally. Of the 120,000 hectares under ECAs (12 per cent of the total agricultural area in Switzerland), three quarters are extensively managed hay meadows, while wildflower strips, (covering a much smaller area of 3500 hectares) are characteristic ECA types for arable regions (SFOA, 2007 in Aviron *et al*., 2009). Voluntary support in the form of agri-environment payments for ecological management is also used to complement the obligatory management within ECAs (Source: Nitsch and Osterburg, 2005).

7.3 Market Based Instruments

The use of market based and other economic instruments for the delivery of public goods, including tradable permits, quotas and taxation, has not been explored to any degree in the EU. However, there is increasing interest in the potential of such instruments, particularly in relation to biodiversity, reduced carbon emissions and water usage. While there are often limitations to their use within the agricultural sector, mainly due to the administrative efforts resulting from the large number of farm businesses involved, some interesting case studies of their use exist outside the EU where these instruments have been deployed, often as a complement to the core policy framework. In addition, there are a number of examples where private companies have sought to contract environmental services directly from land managers, either separately from, or in conjunction with the public sector.

7.3.1 Tradable Quota and Permits

Permits confer an operator the right to carry out certain activities up to a predetermined limit, as specified in a quota. Governments generally need to define these limits, effectively assigning property rights to individuals to form the basis for subsequent trading. Examples are emission permits, providing a business, for example, with a quota on the volume of greenhouse gas emissions that it has the right to emit, or pollution permits, for example, establishing a quota for nutrient surpluses or for the purchase of Nitrogen fertiliser. If these are made tradable they bring about flexibility in the allocation of the limited quantity of emissions or pollution that is tolerated (Polman and Slangen, 2007). Tradable permits or quota have currently not been applied within the agricultural sector in the EU, but examples exist in countries outside the EU, including tradable rights for the development of wetlands for water extraction rights and water quality trading in the United States. There is a debate underway about a possible emissions trading scheme for greenhouse gases for agriculture in New Zealand.

7.3.2 Taxes and Charges

Taxation is another means of influencing farmers' behaviour, although environmental taxes and charges are uncommon in the agricultural sector. An example would be tax reliefs for certain environmental investments or undertakings, tourism taxes where the funds generated are channelled into supporting the land management required for the delivery of public goods, or charges, for example on mineral fertilisers or pesticides.

Taxes are imposed on pesticide products in Denmark, France, Italy and Sweden, and on fertiliser products in Italy and Sweden. Such pollution taxes apply the Polluter Pays Principle by charging the polluter and the market is then left to react to such charges (Polman and Slangen, 2007). The environmental benefits of taxes are generally greatest where the tax has a broad reach in terms of the geographic area to which it applies, but where it only needs to be administered through a limited number of actors - i.e. the fertiliser manufacturers or suppliers - to reduce administrative costs. The enforcement of a tax on mineral Nitrogen fertiliser, for example if it were only applied in a limited area of the EU would require considerable control effort. Ensuring as wide an area as possible for the application of the tax is also important to minimise the possibility of tax avoidance.

In some countries, tourism taxes or charges have been introduced at the local scale, particularly in areas with high visitor numbers, such as those of high scenic beauty or in protected areas. These taxes impose a charge on those visiting a particular area, with the revenue raised being directed back to the area to support the management needed to maintain its environmental value.

Box 7.5 Examples of the use of market based instruments used to stimulate the supply of public goods

Water quality trading is a market-based approach to improving water quality used in some States in the US. It is a tool connecting industrial or municipal facilities subject to wastewater permit requirements (referred to as point sources) with agricultural producers (referred to as non-point sources) to achieve water quality improvements. The catalyst for trading stems from the existence of very specific and measurable goals to reduce the amount of pollutants entering the watershed. Through water quality trading, a point source - such as a waste water treatment plant facing relatively high costs to remove excessive amounts of nitrogen and phosphorous - will compensate another party, such as a farm, for less costly, yet equivalent, pollutant reduction. The trading partners enter into a contractual trading agreement, with financial benefits on both sides, leading to improvements in water quality. For a market to exist, the point source and the non-point source must have different opportunities and costs for pollutant reduction (CLA, 2009).

Cap and Trade – In New Zealand, a cap and trade scheme for nitrogen was set up in 2007 with the aim of reducing diffuse pollution from agriculture affecting Lake Taupo – a major tourist attraction and a UNESCO World Heritage Site. Under the scheme, all farmers in the Lake Taupo catchment who are unable to comply with certain conditions for low nitrogen leaching farming activities must have a resource consent to continue farming.

To gain this consent, a farmer must have a benchmarked nitrogen discharge allowance (NDA) for their holding and a nitrogen management plan (NMP) prepared by a certified advisor. The NDA caps the amount of nitrogen that can be leached from a property in a year. A farmer must not discharge more nitrogen than the benchmarked NDA but can increase the amount of nitrogen discharged by buying or leasing NDAs from other landowners in the catchment who are discharging less than their allowance (offsetting). Farmers with excess NDAs can also sell these to the Lake Taupo Protection Trust. The NMP is based on a nutrient budget and helps famers to manage their farming activities to ensure they do not exceed their NDA. For farms over 100 hectares, the costs of benchmarking the nitrogen leached is funded by the Lake Taupo Protection Trust but smaller farms must pay themselves. The costs of the NMP are also borne by the farmers (IEEP, 2009).

Offsets / Habitat Banking – This instrument permits a business to offset any degradation of natural resources that may result from the development or other use of land by purchasing improvements to a similar parcel of land. In the US, this has been used for 30 years to ensure the protection of wetlands. In California, 'Conservation banking' allows owners that agree to manage large parcels of land in perpetuity for the enhancement and preservation of their natural resource value to sell habitat offset credits to parties that need to satisfy a legal requirement in connection with the environmental impacts of a commercial development project (CLA, 2009; Defra, 2009a).

Taxation - In Canada, the Income Tax Act was amended to exempt all donations of ecologically sensitive land from capital gains tax. This is known as 'The Canadian Ecogift initiative' and has emerged as an important tool in helping to conserve sensitive ecosystems and biodiversity across Canada on private and corporate-owned lands. Two-thirds of the tax on deemed capital gains associated with any ecological gift is exempt (Bräuer *et al*., 2006).

In England, certain heritage properties and associated land can be designated under the Inheritance Tax Act, 1984 which allows inheritance tax to be deferred in return for agreeing to certain 'undertakings' relating to the maintenance and preservation of the character of the properties and the land in question. Heritage Management Plans are drawn up which set out detailed steps that demonstrate how owners must comply with their undertakings. Actions that are in addition to the requirements of the formal undertakings are eligible for funding under agri-environment schemes.

The Netherlands also makes extensive use of tax reductions for gifts to environmental organisations which benefit the environment. Examples include exemption from transfer tax when transfers are made to certain public institutions or nature protection organisations, or exemption from gift or inheritance tax for gifts to nature protection organisations (Bräuer *et al*., 2006).

Charges - In Cumbria, England, the Visitor Payback Scheme, operated through the Tourism and Conservation Partnership, asks visitors to voluntarily support conservation by donating a small amount of money via their bill or entrance fees. Local businesses become members of the Partnership and pledge to raise money for agreed local conservation projects. Through the 'opt out' option, businesses, typically hotels, add a small amount, typically £1 to the customer's bill, and the customer then has the option to opt out of this payment. Currently about £200,000 per year is raised via this initiative for local conservation projects across Cumbria (http://www.ourstolookafter.co.uk/).

7.3.3 Land Purchase, Covenants and Conservation Easements

Under certain circumstances, various institutions and organisations consider the outright purchase of land to be a more cost effective means of protecting and enhancing its environmental value in the longer term. Land purchase most often secures the protection of priority nature conservation areas and their subsequent management according to conservation objectives. However, the purchase of land incurs high fiscal and transaction costs and so it is often only an option for limited areas (Kersten, 2008). In Europe, voluntary environmental organisations, such as the RSPB in the UK, often purchase sometimes sizeable areas of land and either manage it themselves, if they have the capacity and the resources to do so, or rent it out to land managers with strict management requirements (see Box 7.6). In certain cases, the conditions placed on the management of the land may be higher than those established in the legislative baseline or standards of good practice of the Member State in question. Beyond these standards, however, the land managers are generally eligible for funding for the management undertaken via existing incentive schemes.

In the USA and New Zealand, covenants or conservation easements are widely used. For example, in New Zealand, farmers can enter into open space covenant agreements through the Queen Elizabeth II National Trust (QEII). An open space covenant is a legal agreement between QE II and a landowner to protect a special open space feature in perpetuity. The covenant is registered against the title of the property and binds subsequent owners. Support and management of the covenants, as well as specialist advice and monitoring is provided.

Since 1977, more than 85,000 hectares have been protected by covenants taken out by over 2,600 farmers and landowners. These covenants protect a variety of features, including forest remnants, wetlands, lakes, peat lakes, coastline, tussock grasslands, areas of rural landscape, archaeological sites and geological formations (IEEP, 2009). In the USA, Land Trusts - usually charitable organisations - operate at local and regional levels to conserve land for its natural, recreational, scenic and historical value. They can purchase land for permanent protection, accept funds or donations for land purchase, accept donations of conservation easements or, in some instances, purchase conservation easements. Conservation easements essentially buy-out private property rights and impose restrictions (often in perpetuity) on land owners, for example, by preventing the ploughing of grasslands (Swales, 2009).

Box 7.6 Examples of the use of land purchase in the EU

In the Czech Republic, the NGO Czech Association for Nature Protection (CSOP) – funded by the Ministry of Environment – acts as an umbrella for the establishment of land trusts. For example, Moravian Karst, a small land trust, raises money for the purchase of wetlands and other habitats covering an area of 15 hectares. The land trust receives support for administrative costs and for some land purchases from the CSOP. The management of these habitats is funded through national agri-environment schemes (Czech case study).

In Italy in Veneto, the WWF manages eight areas, mostly aimed at the conservation of biodiversity and natural habitats. The NGO Legambiente Veneto also manages some farmland, focused on small-scale farming systems and support is provided for actions that promote high levels of biodiversity provision (Italian case study).

In the UK, the RSPB owns 200 nature reserves covering 130,000 hectares, which are home to 80 per cent of the country's rarest or most threatened bird species. Some reserves require entry fees for non-members (UK case study).

In the east of England, the National Trust owns 11,549 hectares (and leases a further 1,870 hectares) of land, much of which is managed by farmers. The National Trust requires that the land is managed according to certain environmental criteria, and farmers are eligible to apply for agri-environment support to help achieve these goals. Nearly half of this land (5,082 hectares) is designated for its nature conservation importance as Sites of Special Scientific Interest (SSSI), National Nature Reserves, and Areas of Outstanding Natural Beauty (UK case study).

7.3.4 Private Approaches to Environmental Management

There are some examples in the EU where private companies have set up contracts directly with land managers to deliver an environmental outcome in which they have a direct or indirect interest. These initiatives tend to take place on a small scale, within circumscribed areas. In many cases, the management that is required or the investments that are funded are very similar to those prescribed under agri-environment schemes or other rural development measures, however payment rates often tend to be higher and the local nature of such schemes means that targeted advice and information can be focused at the farmers involved. Some examples of such private schemes are set out in Box 7.7.

Box 7.7 Examples of private schemes

Vittel bottled water company - In the early 1980s it was recognised that the intensification of agriculture in the Vittel catchment posed a risk to the nitrates and pesticide levels in the mineral water. To address this issue Vittel decided to provide incentives to farmers to voluntarily change their management practices to reduce contamination. They initiated an incentive package which included payments of €200 /ha/ year over 18 or 30 year contracts; up to €150,000 per farm to cover the cost of all new equipment and building modernisation; free labour to apply compost in farmers' fields; and free technical assistance including annual individual farm plans and introduction to new social and professional networks. All 26 farms in the area adopted the contract. Payments are not conditional on changes in the nitrate levels in the aquifer but are based on new farm investment and the cost of adopting new farming practices. Both nitrate rates and farm management are regularly monitored and recommendations for manure application are adjusted if necessary (Rollett *et al*., 2008). One of the main factors of the success of the scheme has been the trust built up between the farmers and the company as a result of, amongst other factors, a long-term participatory process (Perrot-Maitre, 2006).

Mining company, Spain – The environmental impact assessment of the activities of a mining company in the middle Guadalquivir valley required compensatory measures to be put in place. As a compensatory measure, a "*steppe bird*" recuperation programme **for** the Great Bustard and other species has been implemented, based on the introduction of agricultural practices over an area of more than 300 hectares close to the project site. The payments associated with this measure are far higher than the average AES payments in Andalucia and Spain (Spanish case study).

7.4 Conclusions

This chapter has examined a range of approaches that are either in use or are being piloted in the EU and further afield to encourage the provision of environmental public goods through agriculture. It focused first on those actions that seek to improve the cost effectiveness or enhance the environmental outcomes of existing support measures. Secondly, it examined alternative, potentially complementary approaches, including the use of market based instruments and the funding of environmental outcomes by private actors, many of which are novel at least in Europe. The evidence is in the form of small-scale and pilot initiatives whose broader applicability outside of the specificities of the context in which they are being trialled is difficult to assess, therefore limiting any firm conclusions that may be drawn as to whether they have the potential to offer a significant solution to overcoming the undersupply of environmental public goods in the future.

As demonstrated in Chapter 5, policy support measures, and particularly those where environmental objectives are an explicit aim, are the primary instrument in the EU through which the maintenance and adoption by farmers of environmentally beneficial management practices is incentivised. These measures are supported by a system of advice, training, targets, monitoring and evaluation and enforcement tools. Within this policy framework, there has been a focus, particularly amongst northern Member States, of experimenting with ways of improving the environmental delivery and cost-effectiveness of existing measures, such as the agri-environment measure, through the use of more competitive discretionary schemes, pilot schemes where payments are made on the basis of environmental outcomes, and the use of more collaborative approaches to delivery within a circumscribed territorial unit.

In other parts of the world, most notably in the United States, Australia and New Zealand, and where the agricultural sector is operating in a more liberalised economic paradigm, there are more examples of the use of market based instruments such as auctions, cap and trade, systems for reducing pollution levels, taxation of inputs and habitat banking, as a means of achieving environmental outcomes. Land purchase and covenant agreements are also widely used in the US and New Zealand. Whilst evidence exists of the success of certain of these approaches, as measured through participation and renewal rates for some, this study has not been able to access detailed evaluations of the environmental impacts of these schemes, and this clearly warrants further investigation.

Improving the effective and efficient delivery of public goods is an increasingly important challenge for a current and future agricultural policy and it will be desirable to build on the experience within the EU and in other countries to ensure that the policy response improves over time. The extent to which more conventional and tested policy instruments pursuing environmental objectives will be complemented by some of the approaches discussed in this chapter remains to be seen. It will rest on a full assessment of their effectiveness in terms of environmental outcomes and their budgetary implications, and in recognition that there are often structural limitations inherent to the agriculture sector, such as the large number of actors involved, which may render certain of these approaches difficult to operationalise in practice. None of the approaches examined, however, appear to offer an alternative to agri-environment measures as the primary tool for delivering public goods through agriculture.

8 EXPLORING THE FUTURE PROVISION OF PUBLIC GOODS

8.1 Drivers of Agricultural Restructuring

This chapter explores the implications for the provision of environmental public goods of the key drivers that are likely to influence the trajectory of European agriculture between the present time and 2020. The impacts of these drivers are explored within the context of four policy scenarios, which provide an analytical basis on which to examine both the adequacy of the policy response in relation to future framework conditions, as well as the implications of changes to the budget and architecture of the CAP for the provision of public goods.

In the following section, six key drivers of agricultural restructuring – outside of the CAP – that constitute the framework conditions within which a future policy will be applied are examined. These drivers are:

- Macroeconomic development;
- Consumer behaviour;
- Price developments in agricultural commodities, as well as input prices;
- Technological innovations;
- Developments in the WTO; and
- Impacts of climate change on agriculture.

Macro-Economic Development

Economic framework conditions impact on the demand for agricultural commodities as well as for the environmental public goods provided by agriculture. An increase in purchasing power often results in a shift in preferences towards niche products and food of a higher quality, as well as stimulating demand for increased recreation and leisure opportunities in the countryside (Ghalwash, 2007). Favourable economic conditions may facilitate an exodus from the farming sector by those in search of alternative or better remunerated employment, thus fuelling farm structural change.

Consumer Behaviour

The level of demand for agricultural commodities is influenced by the price of agricultural products, changing lifestyles, the degree of disposable income, marketing by retailers and processors, as well as by local customs. In Europe, shifts in consumption towards more processed food, on the one hand, and towards organic or fair trade products, and those with a protected geographical status are observed (European Commission, 2006). Consumer choices can be expected to evolve in the future, with a range of new forces in play.

Commodity Prices

A combination of factors that influence the supply and demand of agricultural commodities affect prices on the world market. An expanding global population, coupled with economic growth - particularly in emerging economies such as India and China - will result in an increase in the demand for food, feed, fuel and fibres. The prospects for supply are more contentious but there are concerns about reduced rates of increase in cereal yields, the impacts of climate change and water shortages, and the potential diversion of land from food to bioenergy crops, leading to greater fluctuations in supply.

Recent estimates suggest that agricultural commodity prices will remain above the historical average for 1997 - 2006 in the short-term (until 2011). In the medium term, prices are expected to strengthen with economic recovery (DG Agriculture, 2009; World Bank, 2009; FAPRI, 2009). Price volatility (particularly for wheat, maize, soybeans and rapeseed) has increased in recent years, coinciding with decreased stocks (DG Agriculture, 2009). Price fluctuations are likely to continue, despite a projected stabilisation of stocks in the medium term, due to stronger linkages between crop and energy prices, the participation in commodity futures markets of investment funds, and the impacts on production of climate change - eventually translating into higher consumer prices (FAPRI, 2009; OECD-FAO, 2009).

In addition, production costs in Europe are expected to rise in the short to medium term. Energy and fertiliser prices are likely to increase significantly by 2020, coupled with a rise in the cost of buildings maintenance and machinery (Offermann *et al*., 2009). Livestock farms in particular are expected to face increasing costs as the price of feed concentrates develops in line with the price of cereals, while prices for livestock products remain comparatively stable or may even decline, affecting the viability of some farm businesses.

Technological Innovation

Agricultural science and technological development have played a major role in increasing output over the last 45 years, typically leading to productivity increases in relation to land and labour. Research in both the public and private sectors has been the primary source of new technologies, with the private sector becoming increasingly involved in the development and marketing of new technologies (OECD-FAO, 2009). Agricultural productivity growth in the EU has slowed over 2000 - 2006 relative to the 1990s, in common with other developed economies.

However, most projections (for example European Commission, 2007; FAPRI, 2009; OECD-FAO, 2009) indicate continued growth in the output of the main commodities in the short to medium term, with increases in crop yields per hectare and outputs per animal, as well as improvements in feed efficiency, assumed across the EU, stimulated by higher prices driving technological change. It is anticipated that over the next decade rises in agricultural productivity will be greatest in the EU-12 Member States and a rapid adoption of new technologies due to technology transfer is expected.

These trends towards increased productivity may reduce the need for conversion of additional land to agriculture within the EU in response to rising demand for agricultural commodities. The emergence of new varieties and / or technologies may lead to the intensification of marginal agricultural land – where this is economically and agronomically feasible – but are more likely to facilitate the maintenance of agricultural production in certain regions of Europe increasingly affected by climate change.

Technological advances also may lead to significant environmental improvements. For example, technologies permitting the 'fine-tuning' of variable inputs not only result in cost savings, but have the potential to lead to more efficient utilisation of fertiliser, chemicals and water (Blandford and Hill, 2006). The development of precision-farming technologies targeting chemical and water inputs to specific crop needs, and improved soil conservation, all have the potential to reduce the environmental impact of particular agricultural activities.

Developments Under the WTO

The Uruguay Round Agreement on Agriculture has been a key driver of market liberalisation, resulting in a reduction in tariff protection, domestic support and export subsidies in the EU. A future WTO agreement according to the recent 'Revised draft modalities for agriculture' (WTO, 2008) would result in significant changes in market access for agricultural commodities, including tariff cuts of between 48 and 73 per cent, (although tariff cuts for sensitive products, such as beef and sugar, would be roughly half as high), and the abolition of export subsidies.

Whilst this is only one of several possible outcomes, it would result in the EU domestic market for agricultural commodities being more exposed to global competition and price signals than at the present time. Trade balances for beef and sugar, in particular, are likely to be negatively affected by the proposed tariff cuts as they have benefitted from a high level of external protection to date. The dairy market in particular will be adversely affected by the elimination of export subsidies (Brockmeier and Pelikan, 2008), although producers of dairy products, such as cheese, could potentially benefit from improved access to export markets.

Impacts of Climate Change

The expected impacts of climate change are uncertain, and involve changes in temperature and precipitation rates, wider annual variability in climatic conditions, and increases in the occurrence of extreme weather events, all of which have already been observed in Europe. Pronounced regional differences are expected. Large changes in average temperature are unlikely to occur over the next 15 years, and so the expected higher frequency of extreme weather events will be the primary cause of impacts on agricultural production and markets up to 2020, leading to variations in supply, with implications for farm incomes and the price of agricultural commodities (EEA *et al.*, 2008). Increases in agricultural production in high to mid latitudes, coupled with decreases in low latitudes, may impact on trade flows and might be a further driver of intensification in areas which are suitable for agricultural production (IPCC, 2007a).

Future projections imply a further increase in mean temperatures in all seasons, with warmer winters and hotter summers expected in northern Europe and in southern and central Europe, respectively. Mean annual precipitation is expected to increase in northern Europe and to decrease further south, especially during the summer months (IPCC, 2007b). Extreme weather events and an increase in inter-seasonal variability in precipitation and evapotranspiration are also anticipated, impacting on crop yields, with heavier winter rain leading to increased risk of flooding in certain areas (AEA energy and environment and Universidad de Politécnica de Madrid, 2007). These yield losses may outweigh the potential positive effects for food production arising from a moderate increase in mean temperatures (IPCC, 2007a). In combination, these climatic variations are all likely to confer greater uncertainty to agricultural production in the EU (IPCC, 2007b).

Over the longer term, the water balance and the extreme nature of climatic events are critical variables in determining the precise impact on agricultural production. In southern Europe, plant growth will be increasingly reduced by temperature stress and limited water availability, with the largest reductions in crop yields expected to occur in the Mediterranean (Olesen and Bindi, 2002; Alcamo *et al.*, 2005; Maracchi *et al.*, 2005) where drier conditions and prolonged droughts may increase the risk of fire, erosion and potentially irreversible desertification. As a result, farmers may switch to more heat and drought resistant crop varieties or abandon agriculture entirely, which in turn could increase pressure on those areas suited for agricultural production (EEA *et al*., 2008). Projected changes in precipitation patterns will affect soil formation and function, with increased intensity of precipitation leading to higher levels of erosion. Increasing temperatures can be expected to alter the habitat of soil biota, accelerate the release of soil organic carbon, and affect soil functions such as water retention capacity or productivity (EEA *et al*., 2008).

Extreme heat will have direct impacts on animal health, growth, reproduction and output and may also increase the risk of livestock diseases (IPCC, 2007b). Lower grassland productivity in some areas may require new irrigation so increasing competition for water or a switch to alternative forage. Some economic benefits may accrue from the reduced need for winter housing for livestock (IPCC, 2007b).

8.2 Future Policy Scenarios

The aim of the scenario analysis is to provide a qualitative framework within which to explore the provision of public goods associated with European agriculture under a range of future policy settings. The scenarios examine potential trends in agricultural land use and management at the European scale with implications for the provision of environmental public goods. These trends are steered by the drivers outlined above and consequent adjustments in the agricultural sector, such as structural change, but differ in their impact and intensity according to hypothetically diverging policy responses.

The assessment is based on the literature on the drivers of agricultural change, a series of semi-structured interviews conducted between April and June 2009 on the likely regional impacts of the scenarios in the eight case study countries, and is informed by an analysis of FADN (Farm Accountancy Data Network) and FSS (Farm Structure Survey) data to provide information on historic and current trends in farm incomes and structures. In addition, it draws on insights from previous chapters, particularly chapter 3, which examines the interaction of specific land use and management practices and the provision of public goods.

The four scenarios contain consistent assumptions on the main macroeconomic framework conditions, input and agricultural commodity prices, trade and technological change. The scenarios cover the period to 2020 and can be summarised as follows (see Annex XII for further detail on their underlying assumptions):

Reference Scenario: This scenario assumes that European policy remains broadly the same as at the present time but with a 20 per cent reduction in the CAP budget in real terms from 2013.

Liberalisation Scenario: This hypothetical scenario depicts a 'full liberalisation' of agricultural policy and thus assumes the withdrawal of all forms of support in the form of both EU and national measures. It is not intended to be realistic, and serves an analytical purpose to explore the likely implications of the absence of any form of public intervention.

Targeted Support Scenarios: The Targeted Support (TS) scenarios are intended to depict a CAP within which targeted measures play a larger part and account for a greater proportion of the overall budget than in the reference scenario. There are two variants of this scenario:

(a) The first includes a flat-rate, 'basic payment' offered to all farmers conditional on meeting cross compliance requirements but with half the level of current expenditure. There are supplementary LFA-style payments in areas of disadvantage or natural handicap and the EAFRD budget is two thirds higher than in the reference scenario. Most measures under EAFRD would be specifically designed and targeted at the delivery of public goods.

(b) The second explores the provision of public goods through a targeted approach, in which rural development measures are not underpinned by a basic form of farm income support or LFA measure. This would comprise a significantly increased EAFRD budget, double that in variant (a), with an increased minimum share allocated to Axis 2. Payments would be administered according to a programming approach, akin to the current Pillar Two, with the delivery of public goods a primary objective.

8.3 The Reference Scenario

The **reference scenario** assumes that in the period to 2020 European agricultural policy remains broadly the same following the changes resulting from the 2003 reform and the subsequent decisions under the 2008 'Health Check'. From 2013 onwards it assumes the operation of the Single Payment Scheme as of 2013, the full decoupling of all direct payments to farmers but a 24 per cent reduction in the CAP budget in real terms, and with the additional modulation funds agreed following the Health Check, a stable EAFRD budget thereafter.

Continued Structural Change with Increased Specialisation of Farms

A continuation of recent trends is anticipated, with an ongoing decline in small to medium sized farms and a concentration of the Utilised Agricultural Area (UAA) on a smaller number of larger farms. The Scenar2020 study (European Commission, 2006) supports this projection, indicating a 25 per cent decrease in the number of farms across the EU-25 Member States by 2020, with a faster rate of decrease in the new Member States (excluding Romania and Bulgaria) than in the EU-15.

Market dynamics, such as fluctuating commodity prices, along with technological advances, will accelerate the rate of structural change, although the impact of these drivers will be influenced by the availability of support under Pillar One and Pillar Two of the CAP (Nowicki *et al*., 2009). Pillar One payments, especially decoupled direct payments, will contribute to basic income stability for most farms. Pillar Two payments may have a variety of effects. Aid for early retirement, farm modernisation and the establishment of young farmers could assist the creation of larger and more viable holdings (Nowicki *et al.*, 2009). Whereas increased levels of funding available for measures, such as the LFA and the agri-environment measures, could serve to slow down structural change by providing support that makes the continuation of certain land management practices economically viable. A number of other factors may also constrain farm structural change. For example, the increasing diversification in sources of farm household income, particularly through on-farm processing, the establishment of farm shops, developing niche markets for high quality products, and building on the opportunities for agro-tourism, may all contribute to the survival of some small to medium sized farms.

Over time, however, it is logical to expect further specialisation at the farm and regional level, as production is concentrated in the most competitive areas. This is likely to be particularly evident in the arable and dairy sectors with an associated decline in mixed livestock farming systems following existing trends. In the dairy sector, for example, there may be greater concentration in the most competitive regions, such as the Netherlands, particularly with the progressive removal of milk quotas. In countries that up to now have encouraged the retention of dairying in the LFA, such as France and Italy, there may be some migration of dairying to other regions. There is little evidence about what land uses might replace dairying in the uplands and elsewhere - potentially beef cattle or sheep in some areas, and arable, forestry or agricultural abandonment in others (Alliance Environnement 2007; 2008).

Intensification and Improved Production Techniques on Arable Land

Arable production may be expected to grow, due to a possible rise in commodity prices and an increased demand for bioenergy. This is likely to be at the expense of grassland in many regions unless land use conversions are constrained by cross compliance requirements, for example, through restrictions on ploughing permanent grassland to maintain biodiversity and to protect carbon stocks. Loss of grassland could arise from a combination of low profitability of grazing livestock, the increased potential for planting maize as a forage crop, incentives for bioenergy production and reductions in livestock numbers as a result of increases in feed conversion efficiency and climate change policies.

Although specialisation is anticipated as a general trend, a greater diversity of crops may be grown on farms where this is possible in order to reduce dependence on a narrow range of commodities. Several technologies will influence the evolution of land management. A more precise use of inputs can be expected, following wider take-up of integrated production and more advanced techniques, with potential benefits in the form of reduced leaching of nutrients and pesticides to water. Increases in yields and input use can be expected to be greater in the EU-12 Member States than in Europe as a whole, where any increases may be relatively modest, following improvements for many decades. Water shortages will be a constraint in some areas so that irrigation may be reduced in scale and made more efficient. The use of GMO crops can be expected to increase in those Member States with sympathetic governments (The Royal Society, 2009).

Mixed Picture for the Livestock Sector

The simultaneous trends towards intensification on the one hand and land abandonment on the other, already apparent in the livestock sector, are likely to continue. In dairy and some beef and sheep systems, for example in southern Europe, there has been a trend to keep more stock indoors throughout the year, fed a predominantly non-grass diet, such as cereals. Further changes in this direction seem likely (Alliance Environnement, 2007; 2008), although others project an increase in all year outdoor grazing of cattle in certain areas (European Commission, 2007). At the other end of the scale, there will be continued farm amalgamations or transfers of management through rental agreements as smaller and more marginal farms give up.

The beef and veal, and sheep and goat sectors are expected to contract, partly because of farm gate prices. The trend to declines in grazed livestock numbers may be accelerated by reductions in border tariffs arising from a WTO agreement and by climate change policies, where measures may be introduced to cut methane emissions as well as to improve manure management and feed conversion efficiency.

The continuation of decoupled direct payments, Article 68 measures (of Council Regulation 73/2009) in some regions, alongside LFA and agri-environment payments, albeit with a lower overall level of expenditure, are likely to inhibit abandonment, but not prevent it in the most vulnerable areas with poor soils and steep slopes, etc. More generally, a decline in management intensity is expected in these areas, where the land may be nominally managed in order to continue to make claims for direct payments. The extent to which this will occur is difficult to measure on the ground and will be constrained to some degree by the nature of GAEC cross compliance standards and their subsequent enforcement. Nonetheless, some degree of abandonment remains a logical outcome of low returns in the grazed livestock sector and the reduced willingness of new generations of farmers to devote time to forms of management with low levels of remuneration.

8.3.1 Implications for the Provision of Public Goods

Over time, this interplay of different trends will affect production decisions and land use management choices, as well as the availability of a labour and skills base to manage the countryside. Accepting the large measure of uncertainty over several key drivers, such as the degree to which commodity prices are likely to rise and fluctuate, four distinctive trends emerge with implications for the provision of public goods.

Increased Intensity in the Arable Sector with Potentially Negative Consequences for Public Goods

The extent, scale and intensity of production in the arable sector is expected to increase, particularly in the EU-12 Member States. This is likely to be accompanied by greater application of newer technologies and practices, some of which will lead to improvements in water quality and soil management and may reduce greenhouse gas emissions (Royal Society, 2009). Some grassland will be converted to arable, particularly during high price spikes, with adverse consequences for landscape, biodiversity and carbon sequestration. The cross compliance permanent pasture rules will help to constrain the overall rates of conversion of arable to grassland, where these are effectively enforced, and the importance of this measure could increase considerably under this scenario.

In addition, the expected growth in the cultivation of energy crops will have a critical influence on arable production. The extent to which biofuel feedstocks lead to a positive net-GHG-balance of energy from biomass varies widely, not only between crops and different conversion chains, but also depending on the intensity of cultivation and related direct or indirect land use changes. The promotion of first generation biofuel production results in incentives for both more intensive production, conflicting with any extensification of land use for other environmental purposes (Marshall, 2007), and a larger cropped area, potentially reducing the extent of grassland. The GHG-mitigation potential may be partly or even wholly offset by increased N_2O-emissions and loss of CO_2 as a result of land use change (Fargione *et al.,* 2008; JRC, 2008; OECD, 2008).

Fragmentation of Landscape Structures through Ongoing Structural Change

A continuation of current structural and management trends is likely to lead to an increased simplification and fragmentation of landscape structure in certain areas as features are removed or increasingly neglected because of the costs of maintaining them. Where farm size and parcel size increase and mixed farms give way to specialist holdings, habitat mosaics are likely to diminish and landscape diversity will decline, leading to an increasingly homogeneous landscape with the associated loss of biodiversity, landscape character and with adverse impacts on soil and water quality.

Field margins and other features can be protected and enhanced through GAEC standards, by requiring buffer strips, for example, an approach increasingly being adopted in France and the UK, particularly since the end of set-aside. However, it is unclear how many governments will wish to utilise cross compliance in this way in future, particularly if direct payments are lower and average cereal prices higher.

Land Abandonment and Loss of Biodiversity Likely through Reduced Viability of Small and Extensive Farms

The viability of more extensive grazing systems, particularly sheep and suckler cattle, will be increasingly under threat. Reduced viability is associated with a decline in traditional practices, reduced levels of active management and outright abandonment in some places (Clothier and Finch, 2009). GAEC standards and the continued availability of direct payments will constrain the level of abandonment but a *de facto* diminution of management can significantly reduce the biodiversity value of many HNV livestock systems. Parallel issues are likely to arise in the case of more extensive and traditionally managed permanent crops. Larger, older trees are reaching the end of their life or being abandoned, while newer plantations are generally intensive, and fewer public goods are associated with them. The importance of retaining the remaining areas of higher value grazing and permanent crops will increase over time.

For landscapes and biodiversity the trend appears predominantly negative. Maintaining less profitable, mainly grassland based systems will become increasingly dependent on support through the CAP under both Pillars, with Pillar Two being particularly critical for maintaining appropriate forms of management, and not simply the continuation of farming *per se*. Given the limited scale of the Pillar Two budget under this scenario, it will become increasingly difficult to accommodate the cumulative demands on the resources available, not only in the pursuit of biodiversity and landscape goals, but also of those associated with the broad spectrum of environmental public goods.

Lower GHG Emissions but Potentially Negative Consequences for Landscape and Biodiversity through Changes in Livestock Management

The fourth trend is changes in livestock management. With fewer animals, but larger scale enterprises and less permanent grassland on more productive soils, the trend to keep livestock indoors can be expected to continue, with implications for landscape, biodiversity, soils and water. The impacts on landscape and biodiversity of greater concentrations of livestock on fewer and more specialist farms, with more time spent indoors, are predominantly negative. There would also be greater hazards associated with larger concentrations of manure and slurry, although these could be offset by greater uptake of cost effective technological options that may not be viable on small units. Improvements in nutrient management arising from changes in management practices would also help to reduce greenhouse gas emissions, with benefits for water quality and biodiversity. Appropriate rural development policies could contribute to improved nutrient management, although enforcement of existing legislation, such as the Water Framework Directive (2000/60/EC), due to be implemented over the next decade, will be a critical factor.

8.3.2 Policy Implications of the Reference Scenario

The trends summarised above imply that agri-environment policy and GAEC standards will become even more important in securing the provision of public goods. The design, precision and funding of these schemes is therefore particularly significant. Improvements in both effectiveness and efficiency will be necessary as experience with the operation of these policies grows and evidence from monitoring and evaluation accumulates.

In general, the costs of providing public goods will rise as commodity prices increase, elevating the opportunity costs of action in favour of the environment. These are likely to be higher in the most productive agricultural areas which implies higher payments under voluntary measures in those areas where there are compelling ecological reasons for interventions such as habitat creation, the retention and management of landscape features, or the adoption of lower input production methods, with implications for the Pillar Two budget. In the grazed livestock sector this effect may be less pronounced because of declining returns in many areas leading to a greater participation in rural development measures. However, where abandonment is a real threat, as seems likely in some areas, the full costs of retaining an appropriate form of production would need to be paid, net of any market proceeds.

In summary, the demands on those policies that play a critical role in supporting the provision of public goods by agriculture increase in this scenario. The combination of commodity price trends, increased planting of bioenergy crops, declining viability of extensive systems and structural change will create the need for greater incentivisation of farmers to deliver public goods, particularly in the spheres of landscape, biodiversity and soil and water quality.

8.4 The Liberalisation Scenario

Liberalisation Scenario: This hypothetical scenario depicts a 'full liberalisation' of agricultural policy, and therefore assumes the withdrawal of all forms of support in the form of both EU and national measures.

With so many farms dependent on support under the CAP and border protection to maintain their viability, its outright removal with the simultaneous withdrawal of funding for measures under Pillar Two would have major repercussions for agriculture in the EU.

Greatly Increased Rate of Structural Change with Fewer but Larger Farms

Under this scenario, rapid structural change would be experienced, with an acceleration of existing trends as farms seek greater levels of efficiency. There would be a significant decrease in the number of small farms, due to their high dependence on support payments. These include many extensive grazing and mixed farms in the beef, sheep and dairy sectors. The majority of these farms would become amalgamated into larger and more specialised holdings. Modelling work in Germany suggests that bigger farms would grow faster (Kellermann, 2009), however, some grazed livestock systems would continue with very small margins, as they do at the present time. There would also be some land abandonment, although perhaps not to the extent that is anticipated under the Scenar2020 projections (European Commission, 2006) since there would be plentiful opportunities for expansion of existing holdings and greater utilisation of alternative means of maintaining farm viability. In those places where agricultural abandonment occurs, however, the land is likely to be managed for other purposes, such as recreation, for hunting and shooting, or conversion to forestry.

Greater price volatility could be expected under this scenario, given further trade liberalisation and the removal of market support. This would create additional pressures on several types of farms, for example those with heavy debts to service, and perhaps more specialist enterprises, including milk producers who would experience the removal of quota as well as support (Clothier and Finch, 2009). This would reinforce the drivers of structural change. Under these pressures, more farms would pursue alternative income sources and in some cases this would facilitate the continuation of agriculture as one strand of family income. The prevalence of hobby farms and part-time farmers would be likely to grow and in some sectors and regions, farmers may try to add value to their products by seeking a market advantage from distinctive product quality or on the basis of the environmental benefits provided through the production process.

The increase in farm size would also lead to greater average parcel sizes, resulting in the further removal of field boundaries, unless this is constrained through legislation within Member States. The lack of support through agri-environment and other Pillar Two measures could be expected to accelerate the removal and neglect of field boundaries and a wide range of those landscape features and habitats that do not contribute to a marketable output. Flexible, inventive and enterprising farmers, however, would have a greater overall chance of survival, leading to less predictable changes in management.

Increased Area Under Arable Production

There is likely to be a significant increase in arable land at the expense of grass for the cultivation of both food and fuel crops. This is not only because arable cropping is more profitable than livestock production, but arable enterprises also require less labour and can respond to market prices more quickly. The increased volatility in commodity prices would be likely to lead to greater annual fluctuations in the area and types of crops cultivated. In addition, the absence of the permanent pasture requirements under the current cross compliance system would result in the removal of limitations on the conversion of grassland to arable.

Greater Specialisation and New Patterns of Input Use

Further specialisation in agricultural land use in Europe is likely and at a faster rate, with production concentrated in the most competitive areas, as has occurred in the United States where there is a single internal market and fewer barriers to mobility in production. The concentration of highly intensive production would be exacerbated and more functional, less varied landscapes would accompany regional specialisation. Inputs of inorganic fertilisers and pesticides would be increased in some areas in the absence of agri-environment measures and where there were high returns, but elsewhere may be reduced as farmers seek to reduce costs and maximise profit margins.

Declines in the Livestock Sector

A pronounced acceleration in the decline of the ruminant livestock sector beyond that under the reference scenario should be anticipated, driven by competition from imports as well as the removal of support. Ruminant livestock producers would become more dependent on the market. Beef and lamb could be expected to increase in price relative to pork and poultry meat since producers of the latter are much less dependent on support, which may result in a fall in consumption. There would be a considerable contraction in the overall requirement for pasture to graze, particularly in the uplands. Regionally, however, there may be opportunities for some extensive livestock farms to exploit markets for premium products and the dairy sector may be able compete globally on the cheese market, for example. In such a market dominated environment, the growing number of farms trying to add value to their products may lead the emergence of more private sector branding initiatives, with implications for the management of participating farms.

8.4.1 Implications for the Provision of Public Goods

Provision of Most Public Goods under Increased Threat

Under the liberalisation scenario, most environmental public goods would be under increased threat as farms seek to optimise their efficiency in the absence of any public financial support and with greater exposure to imports. Many of the practices most associated with the provision of public goods would be abandoned or displaced, coupled with the removal of the protection offered via GAEC rules, with consequences for soils and landscapes in particular.

The accelerated trend towards larger farms and larger parcel sizes would speed up the removal of field boundaries, associated buffer strips and landscape features, with negative impacts for biodiversity, soils and landscape. This will be further accentuated by the absence of agri-environment measures, with impacts across the whole farmed area as well as at the margins. This would affect practices that improve soil functionality, water quality and reduce input use, with impacts on the appropriate management of both grassland and arable areas. Without incentives, efforts to sequester carbon on farmland are likely to be modest and, without continued support, the scale of organic farming is likely to reduce.

At the same time, some improvements in water quality arising from the utilisation of more appropriate practices and technologies and fewer livestock numbers would be likely to occur, as would reductions in greenhouse gas emissions from the more sparing use of inputs in certain areas. The benefits from reductions in livestock numbers would need to be considered in the round. If European consumers continue to demand the same quantity of beef for example, but a larger proportion is imported, savings in greenhouse gas emissions in Europe would be vitiated by higher emissions elsewhere, leaving aside issues of efficiency in feed conversion and the emissions associated with transport.

8.4.2 Policy Implications of the Liberalisation Scenario

Legislation would play a much more important role under this scenario and its appropriate application and effective enforcement becomes increasingly critical to ensure a basic level of environmental quality. This would put the spotlight on measures designed to reduce pollution in future, such as the Water Framework Directive (2000/60/EC) and the requirement to introduce integrated pest management after 2013. Tensions could arise because of the combination of rising environmental standards, reduced farm viability and withdrawal of both direct payments and targeted support under Pillar Two. Pressure for derogations from certain legislation would be likely to increase.

The lack of investment aid and support for environmental advisory services, as is available through Axis 1 of rural development policy under the reference scenario, would be likely to have a negative effect on those public goods the provision of which requires significant capital investment. Without support, investment by farmers in improved nutrient management or better livestock handling systems, for example, would often not be cost-effective, with potentially detrimental effects on water quality.

8.5 The "Targeted Support" Scenarios

The **Targeted Support scenario** has two variants.

(a): The first includes a flat-rate, "basic payment" offered to all farmers conditional on meeting cross compliance requirements (an evolution of the current direct payments under Pillar 1but with half the level of current expenditure). There are supplementary LFA-style payments in areas of disadvantage or natural handicap; and an EAFRD budget, two thirds higher than in the reference scenario at €25 billion per annum. At least a 40 per cent share of this is allocated to Axis 2 (land management). Most measures under EAFRD are specifically designed and targeted at the delivery of public goods. A 24 per cent reduction in the CAP budget in real terms is assumed, as in other scenarios.

(b): The second variant is a targeted policy with the provision of public goods a major priority, and in which rural development measures are not underpinned by a basic form of farm income support or LFA measure. It comprises a significantly increased EAFRD budget, double that in scenario TS(a), at €51 billion per annum, with an increased minimum share allocated to Axis 2. A 24 per cent reduction in the CAP budget in real terms is assumed and all payments would be co-financed, albeit at a lower rate than currently, with the result that total agricultural expenditure does not exceed that in the reference scenario. Payments would be administered according to a programming approach, akin to that under the current Pillar Two.

These scenarios would represent a major shift in the distribution of support under the CAP, raising interesting questions about how this would affect both the provision of public goods and the underlying viability of the farms concerned.

There would be significant impacts on farm income under both variants because of the redistribution of Pillar One and Pillar Two support. Many extensive farms in the EU-15 and in the EU-12 Member States would benefit because of their greater eligibility for the support available, while more intensive farms would lose income.

The greatly enhanced Pillar Two budget would create the potential for a much extended application of agri-environment and related measures. Farm incomes, however, would need to be sufficient to maintain viability and allow for participation in voluntary schemes. Rural development measures essentially compensate for the additional costs and income foregone of adapting specific forms of land management, or part of the costs of capital investment. Even if payments were more generous with an extended Pillar Two budget, for example, taking greater account of fixed costs, this would not necessarily be sufficient to ensure the economic viability needed to underpin participation in targeted rural development measures.

Shifts in the Balance of Support to More Extensive Farms

It is difficult to forecast the allocation of support between measures, farms and regions, given the central role of Pillar Two in both variants of a targeted support scenario considered here. However, a major redistribution of support could be anticipated with greater concentration on a limited group of farms, many of which would be in the LFA, including a large number of livestock farms. In TS(a), some farms in the LFA would be receiving higher levels of direct payment than under the current CAP. The combination of flat rate area payments under TS(a) together with the uneven pattern of rural development payments would drive a shift in the balance of support towards farms in the EU-12 Member States and more mountainous areas, away from arable farms and those with large Pillar One payments per hectare at present. Pillar Two support would help to stabilise economic viability mainly in the more extensive farms, or where suitable agri-environment schemes were made available.

In the TS(b) scenario, many farms would be under more financial pressure because of the removal of decoupled Pillar One payments and lack of other measures aiming to support viability as a whole rather than to secure appropriate forms of land management. Overall support would be more unevenly distributed between farms and more weighted to those participating in voluntary measures. More diverse income streams would be needed to ensure the ongoing viability of many farms and this may lead to an increase in part-time and hobby farming.

Ongoing but Moderated Structural Change

On account of the reduction or elimination of direct payments, more rapid structural change would be expected under both TS scenarios compared to the reference scenario, with some acceleration of existing trends towards fewer, larger farms. Consolidation and enlargement of holdings are likely to take place on a larger scale in arable areas and on farms experiencing large reductions in their direct payments. These would be most concentrated in north west Europe but would include producers of intensive crops in the Mediterranean. Elsewhere, particularly in the grazing livestock sector, structural change will be constrained to a certain extent by the increased availability of funding through Pillar Two measures, including agri-environment payments, which would be much extended and perhaps enhanced in these scenarios.

The impacts of structural change would be much more differentiated between farm types and regions, given the revised patterns of support. Less structural change would be expected under scenario TS(a) because of the provision of a flat rate area payment and a further payment within LFA areas. These would help to make the continuation of extensive land management practices economically viable. Structural change under TS(a) would therefore be considerably less in areas most associated with public good provision (Nowicki *et al*., 2009).

Impacts in the Arable Sector

Under scenario TS(a) the great majority of arable farms would experience a reduction in direct payments. The extent to which they benefit from targeted rural development measures would depend on the measures advanced by individual Member States. Certain Member States are likely to include agri-environment measures that are potentially attractive to arable farmers, particularly in those parts of Europe where arable production dominates. Such measures might focus on field margins, aspects of soil management and the prevention of water pollution for example. Cross compliance would continue in place with associated GAEC standards. The incentives to expand the arable area noted in previous scenarios would still exist but because of the greater budgetary potential for targeting Pillar Two measures on grassland and the permanent pasture rules within cross compliance, the pressure for substantial increases in the arable area might be diminished.

Under scenario TS(b) by contrast, the arable sector would face the loss of all direct payments. Some of the effects noted in the liberalisation scenario would apply, including accelerated structural change and the loss of cross compliance and the permanent pasture rules. At the same time, more funding would be available for agri-environment measures and these might be expected to apply more widely on arable land than under TS(a). Given the increased exposure to market prices there might be a greater incentive to participate if payment rates were sufficiently attractive. The result might be a patchwork of participation, with some farms choosing to maximise returns and avoid voluntary schemes, and others enrolling at different levels.

Benefits for the Economic Viability of the Livestock Sector

Grazing livestock farms would be expected to benefit from the greater resources devoted to Pillar Two, especially as their provision of public goods tends to be relatively high. Under both variants, it is likely that there would be less land abandonment than in the reference scenario because support would be concentrated on farmland where the probability of management being withdrawn is greatest. Under TS(a) there would be three tiers of support available, including the LFA measure. Whilst abandonment would not be avoided entirely, since some would choose not to take up payments and because Pillar Two support is mainly compensatory, rather than income supporting, it would be confined to a much smaller area.

Under TS(b), the flat rate and universal LFA payments are not available but the resources channelled through agri-environment schemes are greater. Some abandonment may occur where farms fail to meet the eligibility criteria for these payments or where the farmer is deterred from engaging in the paperwork and obligations required for voluntary schemes, or where Member States fail to introduce appropriate schemes. Where abandonment area is a concern under TS(b), there would be arguments for including at least one relatively straightforward support measure in LFA areas where management is broadly compatible with public good provision.

8.5.1 Implications for the Provision of Public Goods

Given the much larger budget for Pillar Two, and Axis 2 in particular, under both Targeted Support scenarios, these broad policy frameworks offer the potential for a substantial increase in the provision of public goods, although the degree to which this is realised in practice will depend on the way in which policy measures are implemented by Member States.

Under both scenarios, agri-environment schemes are likely to expand to allow a greater proportion of farmers to enter agreements as well as enabling more costly management activities to be funded (for example, arable conversion to grassland, habitat restoration and creation in addition to maintenance). This would give more flexibility and the scope for addressing a wider range of public goods, targeting schemes as necessary and adjusting payment levels accordingly.

With enhanced support for extensive systems there would be benefits for the corresponding landscapes and biodiversity although undoubtedly there would be some losses of field margins and other features on arable farms not receiving any support. As well as supporting broad priorities, such as the maintenance of grazing, measures could be targeted on specific problems such as reducing the risks of fire in Mediterranean areas and of flooding in a variety of locations. Schemes aimed at individual species and habitats could be developed more readily. For greenhouse gas emissions, there would be several positive outcomes such as the likely reduction in nitrogen fertiliser use and reduced ploughing of grassland but also some greater pressures as arising from increased ruminant livestock numbers. There will be more resources available for measures targeted at better soil management and carbon sequestration, if match funding is provided.

However, the absence of cross compliance conditions over a large area of farmland under scenario TC(b) would have negative impacts where voluntary measures were not in place. These might be most apparent in relation to landscape quality, soils and biodiversity in the wider countryside outside designated areas, since the protection provided by European legalisation is limited here. By contrast, there are more legislative requirements applying to water quality, which would remain in place. Under scenario TS(a), cross compliance would continue to provide benefits throughout the landscape and would constrain further conversion of grass to arable land.

8.5.2 Policy Implications of the Targeted Support Scenarios

The political preferences, institutional capacity and commitment to allocate resources to measures that encourage the provision of public goods in Member States would have a significant impact on scheme design and implementation. For example, under both scenarios some governments might decide to use a proportion of the expanded rural development budget to fund schemes that could provide some compensation for farmers facing a reduction in direct payments or their complete removal. This might be more marked under scenario TS(b) given the absence of any basic income support payment, and it is likely that some Member States would try to ensure that sufficient levels of funding were focused at 'broad and shallow' agri-environment or similar schemes. Other Member States might choose to target the majority of resources available on key priorities on a more limited land area and be content to allow a proportion of farms to go forward without support under the CAP. In these cases, there would be capacity to make payments targeted at more ambitious interventions more financially attractive, particularly under TS(b) where there is a higher budget available. This would help to secure a higher level of participation in areas of most environmental value. With larger sums available greater investment would be required in scheme management and in monitoring and design so as to ensure that outcomes were satisfactory.

8.6 Conclusions

In the period to 2020, technological advances, market forces, and the impact of climate change amongst other drivers will influence the shape and structure of agriculture in the EU and will affect patterns of production and land management. This in turn will have an impact on the provision of environmental public goods. However, as seen in the scenario analysis, the impact of exogenous drivers on structural change and agricultural management will vary considerably according to the CAP measures in place over the period. Thus, the CAP has an important role to play in shaping the extent to which agriculture provides public goods in the future.

In considering the dynamics of possible future land management, with repercussions for the provision of public goods, a number of themes emerge. Amongst those identified as being particularly significant are the enlargement of farm and field size, the conversion of grassland to arable farming, growth in the area under bioenergy crops, reductions in the number of grazing livestock, a trend towards farm and regional level specialisation, with more livestock housed indoors, a withdrawal of management in more marginal areas, an intensification of practices in EU-12 countries, and overall improvements in energy efficiency.

The scenarios afford a perspective on how different policy instruments within the CAP would influence outcomes in the face of these drivers. Under the reference scenario, for example, the twin processes of marginalisation and intensification are expected to diminish the provision of some public goods, particularly in the realm of landscape and biodiversity. The reductions in support within the CAP under this scenario hamper the capacity of the policy to address the undersupply of public goods in an effective way.

The liberalisation scenario results in a considerable accentuation of these pressures and an acceleration of structural change, leading to intensification of agricultural practices on the one hand and to marginalisation and land abandonment on the other. The effects on public good provision would be largely very negative although certain public goods would continue to be provided.

The Targeted Support scenarios introduce the possibility of concentrating considerably more resources on the provision of public goods than in the reference scenario. Interesting questions are raised about how far this policy approach would be able to increase the provision of public goods through agriculture. Two different scenarios were analysed with a varying weighting given to different measures. Under variant TS(a) most farms, including those disinterested in voluntary agreements, receive decoupled direct support, which is untargeted, but the link to cross compliance is retained, thereby helping to maintain basic environmental standards. Given the much larger budget for Pillar Two and Axis 2 in particular, the potential for increasing the provision of a range of public goods is increased substantially. This would need to be achieved by good policy design in the Member States. In addition, the decoupled direct payments would strengthen the economic viability of smaller, more extensive and other farms that may be providing public goods. The scenario identifies the importance of balancing highly targeted measures with sufficient attention to underlying farm viability.

In TS(b), double the funding is available for rural development measures compared to under TS(a), providing scope for greater levels of targeted investment in a full range of public goods but without any contribution to farm viability from decoupled direct payments or the assurance of a basic level of environmental maintenance through cross compliance. Whilst measures are more targeted, the implementation relies very heavily on the political preferences, institutional capacity and commitment to allocate resources to such policies in the 27 Member States and there are questions about how Member States would respond to the greater flexibility available to them. As a result, the provision of public goods under this scenario appears likely to be subject to greater variations between Member States and is more difficult to forecast. On the one hand, an attractive and well targeted budget is available. On the other hand, with no cross compliance standards and the probability of structural change in large parts of the agricultural sector comparable to that under the liberalisation scenario, it may be difficult to moderate the threats to public good provision arising from the type of management on those farms not participating in targeted measures.

The different scenarios highlight the potential of measures within the CAP in helping the agricultural sector to fulfil its potential with respect to the provision of public goods. To play this role, agricultural land use will need to be economically viable and sufficient incentives available to encourage appropriate management. The different scenarios highlight this aspect well, indicating the need for a consistent set of CAP measures. However, such policy questions need to be seen in the wider context of European land use debates. In addition to meeting society's requirements for environmental public goods, there are competing demands on land in Europe, which are likely to be exacerbated in future. Many will be in direct conflict with the provision of public goods and thus contribute to an increased risk of undersupply unless there is sufficient political intervention.

9 CONCLUSIONS

The purpose of this report is to examine the concept of public goods as it applies to agriculture in Europe and to examine how far there is a case for policy support measures to encourage the provision of those public goods provided by agriculture. The evidence draws on a range of secondary sources, including the literature, evaluation studies, an in-depth analysis of the policy framework, along with detailed information collected from eight regional case studies that were conducted in the Czech Republic, France, Germany, Italy, Romania, Spain, Sweden and the UK, between April and July 2009.

A Clear Concept and Definition

The public goods concept is well established in economic theory, and defines public goods by the characteristics of non-excludability and non-rivalry. It is widely argued that securing the provision of public goods provides a valid reason for public intervention in a market economy, given that markets cannot function to secure their supply. In order to provide a sound basis for policy making, it is essential to be clear about which public goods are provided by agriculture and where the CAP has a legitimate role in encouraging their provision.

The concept provides a robust framework for identifying and defining the public goods associated with agriculture in the EU. The report concludes that the most significant public goods provided are environmental and a more diverse suite of social public goods. These public goods are agricultural landscapes, farmland biodiversity, water quality, water availability, soil functionality, climate stability (reduced greenhouse gas emissions; carbon storage), air quality, resilience to flooding, resilience to fire, food security, rural vitality, and farm animal welfare.

All share the defining characteristics of public goods to a varying degree. Many of these are complex entities, with both public and private characteristics. As such, public intervention is not always necessary to secure the supply of the multifaceted whole. Food security provides an example of a public good with distinct private characteristics. Although markets are the best regulators of food supply, there are hazards arising from a potential shortfall in supply that do not arise with other commodities less central to human welfare. Therefore, whilst the case for public intervention in relation to food security *per se* is small, ensuring access to affordable and safe food at all times warrants government action.

A Focus on Environmental Public Goods

The study focused on a coherent suite of ten environmental public goods (agricultural landscapes, farmland biodiversity, water quality, water availability, soil functionality, climate stability - carbon storage and climate stability - greenhouse gas emissions, air quality, resilience to flooding and resilience to fire). The reason for this focus was because there is evidence for the undersupply of these environmental public goods relative to the scale of societal demand and because they have an important interaction with agriculture. This renders them a priority for public policy and the case for intervening through the CAP is strong.

The social public goods provided through EU agriculture were not explored further within the context of this study, although future investment in research to define these public goods and their relationship with agriculture more precisely, to develop indicators to detect undersupply where it exists, and to assess the scale of public demand is clearly a priority to inform future policy discussions.

Public Goods Provided through Agriculture are Valued by the European Public

The study demonstrates that the European public places a high value on the environment. Attitudinal surveys indicate widespread concern for environmental issues - particularly with regard to biodiversity loss, the mitigation of climate change, water and air pollution, and the depletion of natural resources, including soils. In certain Member States, there is well documented demand for access to the countryside, protected areas and certain landscapes, as captured through the large numbers of visitors to National Parks and nature reserves, and the fact that a significant proportion of the population are members of environmental non-governmental organisations. In addition, multiple studies have been conducted using contingent valuation and other methodologies to reveal social preferences for landscape and biodiversity, in particular. These assess a wide range of positive values, including non-use values, and a hypothetical willingness to pay for certain environmental goods and services even though the individuals expressing these preferences may not be direct users of the goods in question. The collective values that society places on the environment are in turn reflected in political targets which specify a desired level of public good provision.

A Range of Second Order Social and Economic Effects Depends on the Existence of Certain Public Goods

In addition to the inherent value of public goods to society, a range of second order social and economic benefits occur that depend, partly or wholly, on the existence of the environmental public goods provided through agriculture. The generation of these second order benefits highlights the importance of maintaining and enhancing the state of the environment and the countryside not only for its intrinsic value, but also for the potential that it plays in stimulating economic activity in certain rural areas, thereby enhancing their vitality and the quality of life of those who live in these areas, as well as of society more broadly.

There are multiple influences on the economic development of rural regions in Europe, however, the potential for a region to build on its environmental, social and cultural capital to derive an economic benefit is widely documented in the literature. In certain regions of Europe, attractive agricultural landscapes, the presence of farmland biodiversity and historical features, provide economic opportunities for a wide variety of economic activities, including rural tourism and recreation, speciality products and foods, as well as providing an attractive location for the establishment of businesses.

The study demonstrates, however, that the relationship between environmental assets and economic development is not always in harmony. Often, economic development competes with environmental outcomes for the use of scarce factors of production. As such, basing economic development on the presence of public goods must be undertaken in an environmentally sustainable and sympathetic way. There is evidence from the Romanian case study, for example, to suggest that whilst there is a growing recognition of the opportunities for tourism that the attractive landscapes in southern Transylvania provide, certain investments have damaged the environment, threatening the very resource upon which economic development rests.

Economic benefits of this kind are not confined to the more vibrant rural areas. The activities necessary for maintaining public goods - such as the maintenance of farmland features, terraces and stone walls - also provide economic and employment benefits that may accrue directly to the farmer or to local contractors. Studies have demonstrated that public funds, invested through agri-environment schemes, for example, generate employment and income opportunities both for the farmer and for contractors, and encourage the retention of traditional skills. In addition, the products of certain environmentally-sustainable farming systems have the potential to be differentiated on the basis of their association with particular production methods or settings and on this basis, to attract a premium price. Whilst many product certification and labelling schemes are likely to help farmers to secure a premium price for their product, there is little quantified evidence of the extent to which they help to maintain farm viability in the longer term.

The challenge of securing stewardship of this complex array of environmental, social and cultural assets in particular rural localities implies the need to ensure that economic development unfurls in an environmentally sustainable manner. In addition, there appears to be a need not only for policies to encourage the provision of environmental public goods, but that the policy framework is sufficiently integrated to ensure that where social or economic synergies occur, they are promoted.

Particular Types of Agriculture Provide a Range of Public Goods

It has been demonstrated that a wide variety of environmental public goods are provided by agriculture in the EU. Their distribution and provision is not uniform across all forms of agricultural activity nor is their provision constant over time. Certain characteristics of agriculture influence the degree to which public goods are provided, including: the crop cover and agricultural land use in a broader sense; the practices applied and their sensitivity to the local environment; the farming systems being followed; the size and structure of the farm, including the size of fields and scale of operation; and the agricultural infrastructure in a given locality, including patterns of drainage and irrigation.

The scale at which beneficial management is applied, as well as the presence of historic landscape features and the continuity of certain practices over time, has a considerable influence on environmental outcomes. This means that the provision of public goods will be subject to discrepancies and individual variations from farm to farm, and between regions and climatic zones. Ultimately, however, the provision of any given public good will depend on a deliberate decision on the part of the farmer to allocate his / her factors of production and resources in an appropriate manner.

A review of the literature, coupled with an expert-led assessment of beneficial farming systems and practices conducted expressly for this study, indicated that a number of farming systems and the practices employed within them are particularly important for the provision of public goods. These include extensive and mixed systems, the more traditional permanent crop systems and organic systems.

The evidence also indicates that there is a large potential for highly productive farming systems to adopt environmentally beneficial production methods and thereby to provide public goods. There are three main clusters of farming practices that may be deployed to secure environmental benefits. These include the adoption of a suite of practices that are inherently less intrusive on the environment; specific practices which lead to improvements in energy efficiency and reductions in greenhouse gas emissions (typically associated with intensive livestock production); and more targeted practices that are designed to address a specific environmental concern, for example, the use of buffer strips or reduced tillage on arable farms.

The Need to Encourage Environmentally Beneficial Agricultural Management

Many of these beneficial forms of agricultural land management are under threat. Market forces and technological advances continue to drive the search for efficiency gains stimulated by a growth in demand for food, bioenergy and other industrial products, coupled with pressures from the built environment. One consequence of these trends is a likely increase in the extent, scale and intensity of production in the arable sector driven by market forces and technological advancements, particularly in the EU-12 Member States, leading to changes in land use patterns, such as the conversion of grassland to arable, and land management with adverse consequences for the preservation of landscape and biodiversity, carbon sequestration and other public goods.

These changes are often paralleled by an increase in the opportunity costs of action in favour of the environment which are likely to be higher in the most productive agricultural areas. This implies higher payments under voluntary measures in such areas where there are compelling ecological reasons for interventions such as habitat creation, the retention and management of landscape features, or the adoption of lower input production methods.

In addition, the economic viability of more extensive grazing systems, as well as those in naturally disadvantaged areas is in decline. Reduced viability is associated with a loss of traditional practices, diminished levels of active land management and outright land abandonment in some places. Fewer livestock and less permanent grassland on more productive soils carry implications for landscape, biodiversity, soils and water, and are likely to result in deterioration in the landscapes and the habitats essential for the survival of particular farmland species. Support for the maintenance of these environmentally beneficial farming systems will be a critical component of any new policy formulation if the undersupply of public goods is to be addressed in a satisfactory way.

There is Evidence of Undersupply of Public Goods Relative to Public Demand as Expressed in Political Targets

Political decisions about the desirable level of provision of public goods should, in principle, be made on the basis of a well founded understanding of societal demand. In recent years, the number of targets in relation to the provision of environmental public goods has both proliferated and increased in their level of ambition. Targets set in relation to greenhouse gas emissions, soil quality, water quality and availability, and resilience to flooding, in particular, have been added progressively alongside more established targets relating to species and habitats. Certain of these are explicit targets set at the EU level, which exist predominantly in relation to biodiversity, habitats, water quality, greenhouse gas emissions and air quality, and typically prescribe clear and often quantified goals. For other public goods, such as agricultural landscapes, where no explicit targets exist at the EU level, implicit targets are embedded within particular policies such as those found within the Community Strategic Guidelines for Rural Development.

In order to assess whether society's demand for public goods is being met, indicators provide a measure of whether the state of a given environmental medium or ecosystem is improving or declining over time. As such, they provide an indication of whether the supply of public goods associated with agriculture is sufficient. All of the 36 relevant EU-wide indicators suggest a situation of undersupply, although there have been improvements in air quality, regional improvements in soil quality, and a reduction in greenhouse gas emissions from agriculture. The situation is unsatisfactory and even where improvements have been made there is clearly scope for further progress, especially with respect to reducing greenhouse gas emissions in light of recent political commitments and broad societal concern.

Specifically, individual state of the environment indicators point to ongoing declines in the populations of farmland birds (although over the last decade, the situation has stabilised at the EU level), the poor conservation status of a majority of Natura 2000 sites, high rates of soil erosion by water and wind, a depletion in soil organic matter, the poor 'ecological status' of many water bodies resulting especially from diffuse pollution, high levels of water abstraction, particularly in water stressed areas, and a decline in the character of valued landscapes threatened by a loss of landscape elements, simplification and reduced management.

Based on the available evidence, certain environmental media and geographical areas emerge as clear policy priorities - specifically the Mediterranean area and the Iberian Peninsula with respect to the maintenance of High Nature Value farmland, the prevention of soil erosion, improving water quality and encouraging more sustainable water use. Maintaining HNV farmland in central and eastern Europe is another priority, but a shortage of data for the new Member States at the present time may simply be concealing other, equally urgent policy issues in these 12 countries.

The evidence from indicators is further substantiated when estimates of the monetary value of environmental goods and services and the cost of policy inaction are taken into account. The few macro-level studies that have been undertaken to date indicate that the monetary values may be very large, and that the welfare losses associated with their degradation are of a similar magnitude. They suggest that society is systematically underestimating the scale of environmental degradation and that the cost of action to improve environmental delivery may be considerably less than the cost of inaction. As such, these estimates provide a important stimulus for strengthening the actions and budgetary resources necessary to induce the delivery of the desired level of environmental public goods.

There is a Clear Case for Public Intervention

Given the strength of public support for public goods and the shortfall in the provision with respect to current and prospective targets, there is a clear case for public intervention with respect to all of the categories of public goods that form the focus of this study. Indeed, there appears to be significant public interest in securing sustainable levels of the environmental public goods provided by agriculture in the longer term. Government action is necessary to achieve this.

The most appropriate scale of intervention depends on a number of factors. Many of the public goods provided by agriculture, such as climate stability or biodiversity, are transboundary in character, whereas others, such as resilience to flooding or fire, may be defined as local or regional public goods. Whilst these characteristics exert some influence on the scale of intervention in line with the principles of subsidiarity and fiscal equivalence, there a number of reasons for intervening at the European scale. Many of the public goods have a strong cross border element or are matters of EU common interest. As a result, securing their provision is an appropriate subject of EU policy. Furthermore, financial solidarity in bearing the costs of providing public goods adheres to the principles of social and economic cohesion.

The CAP has an Important Role in the Provision of Public Goods

The CAP, with a budget of €53 billion per annum, exerts an important influence on agricultural land management in the EU and therefore has considerable potential to influence the scale of delivery of public goods. In addition to the CAP, dedicated funding for a range of public goods also exists but at a smaller scale, and is administered through the LIFE + programme, the Structural Funds, as well as specific national measures in all Member States.

Certain measures within the CAP, and most notably the agri-environment measure within Axis 2 of Rural Development policy, have explicit environmental objectives. Other Axis 2 measures can support environmentally sympathetic management on farms, such as those concerned with the LFA and Natura 2000 sites. Many of these measures have been shown to be targeted at a wide a range of public goods, with positive impacts.

There are other CAP measures, such as the decoupled direct payments under Pillar One of the CAP, which make a substantial contribution to farm incomes. A large number of farms in receipt of these payments deliver public goods and certain of these may rely on these payments to maintain their economic viability, thereby enabling them to continue to provide public goods. Other farms in receipt of these payments, however, may not be providing public goods or may even be causing environmental degradation. Linking direct payments to standards of Good Agricultural and Environmental Condition (GAEC), therefore, contributes to providing basic levels of public goods. In addition, measures applied under Article 68 of Council Regulation 73/2009 may support either specific types of farming important for environmental protection or certain agricultural activities with environmental benefits.

The analysis suggests that the essential approach of pursuing environmental outcomes by combining cross compliance and incentive based measures over and above a regulatory baseline is an appropriate one. This combination of targeted measures applied under Rural Development policy and direct payments in association with cross compliance has brought farmers' attention to environmental issues in a much more prominent way, influenced a range of business and management decisions throughout Europe, helped to prevent abandonment on a significant scale, extended the application of a number of beneficial practices and contributed to the maintenance of more extensive and organic farms over a significant area.

Whilst there is evidence of undersupply in most of the key environmental public goods provided by agriculture, the current policy effort has been effective in stemming a trajectory of decline in several respects. In the face of pressures to concentrate and specialise production, to increase economies of scale and to maintain competitiveness, environmentally beneficial management practices have tended to be replaced by those that pursue efficiency gains, partly at the expense of the environment. Operating within the context of these broader economic forces, policy measures, such as the agri-environment measure, have in many cases had some success in stemming the decline of beneficial management practices that might otherwise have been experienced.

That said, there are a number of reasons why the current policy framework has not achieved the improvement in the provision of public goods on the scale that is required. These relate to the relative weight afforded to the different objectives of policy, the choice of policy instruments, the design and subsequent implementation of policy measures, the extent of governance and institutional capacity and critically, the adequacy of budgetary resources. Indeed, current levels of expenditure on rural development measures with environmental objectives appear insufficient when compared to the scale of societal demand and estimates of the scale of funding required to meet EU targets for specific public goods.

Future Policy Needs

In looking ahead at the outlook for agriculture in the EU over the next decade or more, changes in land use and management will alter the conditions for the provision of public goods. The drivers of agricultural restructuring point to a diminution in the practices needed to provide these goods but there are also examples of trends in the other direction, such as increases in the energy efficiency of farming operations. That said, it seems likely that the incidental provision of environmental public goods by farmers will decline and additional demands will be made on policy interventions to address undersupply.

Policy intervention will be required across a large proportion of the farmed area, including the more intensive arable regions, to ensure the retention of soil functionality, the maintenance and improvement of water quality, reductions in greenhouse gas emissions, improved sequestration of carbon and enhanced resilience to flooding, as well as contributing to landscape and biodiversity goals. Alongside these interventions at the landscape scale, specific measures which are more precisely targeted in the locations where the supply of public goods is particularly concentrated, notably in the more extensively grazed areas, will also be critical.

Six Challenges for a Future EU Agricultural Policy

The need to provide public goods in Europe would be a valid and coherent justification for a future CAP. The challenge of encouraging this provision of public goods on the scale required to meet societal demand is considerable but the policy has several strengths for this purpose. The integration of the Göteborg principles on sustainable development into the CAP over the course of successive reforms provides sufficient scope for a wide range of policy actions affecting agriculture and environmental land management. In addition, the CAP provides a coherent European framework, taking account of common goals, the common market for agriculture and the need to maintain a broadly level playing field for farmers. It has the flexibility to take account of varying regional and national conditions without losing transparency if policies are well designed and administered.

Confronted with the challenge of addressing the undersupply of public goods, the CAP would need to retain a range of instruments capable of addressing the wide variety of agricultural conditions in Europe and the full suite of environmental public goods.

At present, direct payments contribute to enhancing the economic viability of farming and serve as a foundation for more targeted measures pursuing the provision of public goods. However, linking those payments, through cross compliance to a robust regulatory baseline is considered essential in addressing environmental issues in the countryside. Regulatory demands are scheduled to increase over time, for example, as the implementation of the Water Framework Directive is taken forward, and any future agricultural policy will need to adapt to such changes in the legislative baseline.

Following the Health Check of the CAP, some measures can be targeted at environmental objectives via Article 68. The report concludes, however, that given the well established delivery mechanisms of Rural Development policy, targeted measures to secure the provision of public goods, may be more effectively administered through Rural Development policy.

Six key challenges can be identified if we look ahead towards a revision of the CAP in which the focus on the provision of environmental public goods is strengthened. These six challenges are:

- Giving more emphasis to the integration of environmental objectives at the heart of the policy: A consistent policy framework is needed to manage tensions in policy objectives and to ensure that an appropriate balance is struck between the economic, social and environmental dimensions of sustainable agriculture.

- Establishing appropriate targets: With a focus on environmental public goods, it will be important to establish clear targets for the full range of public goods that relevant policy measures are intended to deliver.

- Enhancing the effectiveness and efficiency of measures: Selecting the policy measures required to achieve these targets at a European level requires that due attention is given to the need for measures to be both effective and efficient.

- Improving implementation: The use of a range of policy measures in synergy can help to achieve better results. This requires a coordinated approach to scheme design and the fostering of increased institutional capacity at the Member State level, including the provision of advice and capacity building to farmers.

- Effective monitoring and evaluation: The monitoring and evaluation of the impacts of expenditure under the CAP is critical to ensure accountability and to allow for improvements to be made in terms of the design and targeting of support. The Common Monitoring and Evaluation Framework (CMEF) for Rural Development Policy provides a solid foundation in this respect.

- Securing sufficient budgetary resources: Calculations concerning funding requirements demonstrate the significant difference in the scale of funding estimated to be needed to achieve European environmental targets, and that currently available for those CAP measures targeted towards public good provision. Securing sufficient budgetary resources for supporting the provision of public goods would appear to be a clear priority for the future.

Competing Demands on Rural Land in the EU

In addition to meeting society's requirement for environmental public goods there are competing demands on land use in Europe which are likely to be exacerbated in future, flowing from expectations about food and bioenergy supply, the challenges faced by farmers in less developed regions, as well as the need to accommodate further urban development and space for recreation. Changes in land management will arise from these pressures, with increasing intensification and the growth of the area under arable production a likely impact of some of these trends. Many will be in direct conflict with the provision of public goods and thus contribute to an increased risk of undersupply where there is insufficient political intervention.

Given that land is a finite resource, the provision of public goods associated with land use must reflect the social optimum in Europe, both at the present time, and also take into account the needs and requirements of future generations. What is considered to be in society's best interest will reflect common objectives for food, the environment, bioenergy and social and economic cohesion, but it is essential that all of Europe's priorities are assessed in a strategic and integrated manner, with full consideration given to the trade-offs that achieving these objectives may imply. Finally, not all of Europe's broader requirements arising from agriculture are met by land managers within the EU, which relies heavily on imports of food and other bio-materials. This underscores the need to consider the global pattern of land use and agricultural activity when thinking about agriculture's role in providing society with a stream of both public and private goods.

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LIST OF CONVENTIONS, PROTOCOLS, DIRECTIVES, REGULATIONS, STRATEGIES AND ACTION PLANS CITED IN THE REPORT

International Conventions and Protocols

Convention on Biological Diversity, Rio de Janeiro, concluded 05.06.1992, entered into force 29.12.1993, I-30619.

Convention on Long-range Transboundary Air Pollution, Geneva, concluded 13.11.1979, entered into force 16.03.1983.

Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention), Ramsar, concluded 02.02.1971, entered into force 21.12.1975, I-14583.

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Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto, concluded 11.12.1997, entered into force 16.02.2005, I-30822.

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Directives

Birds Directive:
Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds (OJ L 103, 25.04.1979).

Environmental Impact Assessment Directive:
Council Directive 97/11/EC of 3 March 1997 amending Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment (OJ L 073, 14.03.1997).

Floods Directive:
Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks (OJ L 288/27, 06.11.2007).

Groundwater Directive:
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Habitats Directive:
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Integrated Pollution Prevention and Control (IPPC) Directive:
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National Emission Ceiling Directive:
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Nitrates Directive:
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Pesticide Framework Directive:
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Proposed Soil Framework Directive:
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Waste Directive:
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Addressing the challenge of water scarcity and droughts in the EU: Communication from the Commission to the European Parliament and the Council - Addressing the challenge of water scarcity and droughts in the European Union, COM(2007) 0414 final, 18.07.2007.

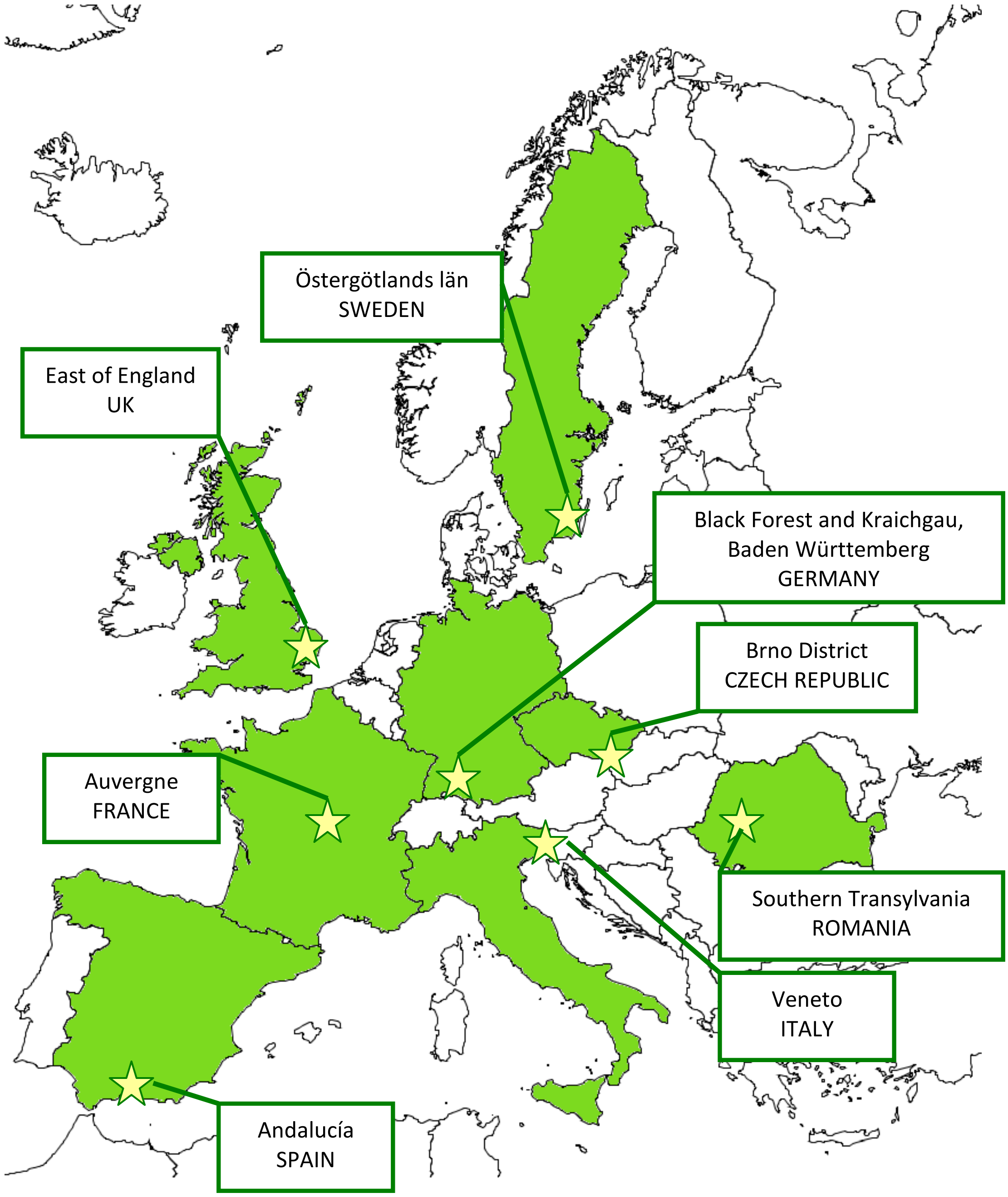
ANNEX I THE EIGHT CASE STUDIES

The empirical data that underpins this study was collected through eight in-depth case studies with a regional focus. The case studies were conducted between April and July 2009 and comprised qualitative interviews, a review of the legislative and policy framework, and an analysis of policy evaluations and indicators, resulting in quantitative and qualitative data on the range of public goods provided and the policy response in eight EU Member States.

The eight case study countries (Czech Republic, France, Germany, Italy, Romania, Spain, Sweden and the United Kingdom) were selected to capture a wide range of agricultural production systems, under varying geographic and environmental conditions, with a mix of old and new Member States (as set out in Annex Table 1 below). The case study countries also vary in the extent to which they prioritise – through policy – the delivery of public goods through agriculture over other agricultural issues such as improving the competitiveness of the farming sector, and in the nature of the policy response and the instruments used. They aim to be illustrative of the broader picture across the 27 EU Member States, although given the diversity in agricultural land management across the EU, there is clearly much specificity, and certain examples serve as vignettes to illustrate this diversity.

Annex Table 1 The eight case study regions

	Case Study Region	Farming System	Focus
Czech Republic	Brno District NUTS 4	Intensive arable Intensive livestock	Explores the public goods provided through relatively intensive forms of land use.
France	Auvergne NUTS 2	Extensive livestock – sheep, dairy	Investigates the provision of public goods associated with HNV livestock system under threat of structural change and land abandonment.
Germany	Black Forest and Kraichgau, Baden Württemberg NUTS 4	Extensive dairy Intensive arable	Investigates the provision of public goods associated with land uses of contrasting intensity within the same region.
Italy	Veneto NUTS 2	Extensive livestock – dairy Permanent crops – fruit and vines	Investigates the provision of public goods associated with upland extensive livestock systems and more intensive permanent crop production.
Romania	Southern Transylvania (NUTS 2), including areas of Alba, Sibiu, Mures, Brasov, Harghita and Covasna	Extensive livestock – sheep Complex mosaics of extensively managed arable and grassland	Investigates the provision of public goods associated with HNV, semi-subsistence livestock systems.
Spain	Andalucía NUTS 2	Dryland extensive arable Intensive and traditional olive	Explores the provision of public goods provided through extensive and intensive systems under severe climatic conditions.
Sweden	Östergötlands län NUTS 3	Extensive livestock – beef sheep and horses grazing meadows within deciduous wooded landscape Fallow Intensive arable.	Explores the provision of public goods provided through landscape values where there is a threat of forest encroachment.
UK	East of England NUTS 2	Intensive arable Grazing livestock.	Explores the provision Captures a range of land uses including pigs, intensive beef, sugar beet etc.



Annex Figure 1 **Map showing the location of the eight case study regions**

ANNEX II ASSESSING THE EXTENT TO WHICH FARMING PRACTICES AND FARMING SYSTEMS PROVIDE PUBLIC GOODS

Rationale

No comprehensive account of the provision of environmental public goods by diverse farming operations in the EU exists at the present time. Much of the information can be derived from the literature and in assessments of the environmental impacts of individual agricultural activities, farming systems and types of agricultural land management. A review of this literature has formed the main basis of the commentary in Chapter 3. To supplement this, a qualitative, expert led assessment of the benefits of individual farming practices and a range of farming systems was conducted specifically for this study. Whilst this expert led process offers only a partial assessment – and there will be regional differences in terms of those farming practices and systems which provide public goods influenced by a host of location-specific factors – this assessment offers a first attempt to provide an EU-wide overview of the provision of public goods in the principal farming systems in Europe based on an analysis of individual practices. It develops a methodological approach and provides a starting point for a more in-depth analysis in the future.

Aim of the Assessment Exercise

The aim of this exercise was as follows:

- **To draw up a list of individual farming practices that provide one or a range of environmental public goods.**

- **To compare within individual farming systems the extent to which farming practices provide one or a range of environmental public goods.**

- **To compare across 13 farming systems, the extent to which each system provides one or a range of environmental public goods, or has the potential to do so.**

Methodological Approach

The methodological approach comprises four key steps which are described in more detail below:

1. An initial classification of farming systems in the EU.
2. An identification of farming practices that provide one or a range of environmental public goods.
3. An identification of the farming systems with which individual practices are associated or are most likely to occur.
4. An expert scoring of the practices to assess the extent to which they provide, or could provide one or a range of public goods.

1. Classification of farming systems

A fairly simple classification of farming systems in the EU was devised for this study, reflecting differences in land use and production intensity as well as the principal types of crop (see Annex Table 2). Given the focus on environmental public goods, the distinction between intensive and extensive systems is a key element of the classification. This can be defined in various ways, generally referring to either the level of inputs used, or the outputs produced per unit area, or both. With grazing livestock the density of animals kept per hectare of forage is a common measure of intensity. It is difficult to propose any precise thresholds between intensive and extensive in what is effectively a continuum, influenced not just by the farmer's choice of system but by the soils, climate and existing vegetation in any given location.

Annex Table 2 The thirteen farming systems identified across the EU

<table>
<tr><th>Livestock</th><th>Arable</th><th>Mixed</th><th>Permanent Crops</th><th>Specialist Field Crops and Horticulture</th></tr>
<tr><td>Permanently housed intensive livestock</td><td rowspan="2">Intensive arable</td><td rowspan="2">Intensive mixed arable/ pastoral</td><td rowspan="2">Intensive permanent crops</td><td>Horticulture under glass</td></tr>
<tr><td>Intensive dairy/ beef/ sheep</td><td>Horticulture field crops</td></tr>
<tr><td rowspan="2">Extensive outdoor livestock and silvo-pastoral</td><td rowspan="2">Extensive arable</td><td rowspan="2">Extensive mixed arable/ pastoral</td><td rowspan="2">Extensive permanent crops</td><td>Rice</td></tr>
<tr><td>Legumes, pulses, field vegetables</td></tr>
</table>

Identification of farming practices that provide public goods

Following the classification of the main farming systems in the EU, step 2 of the methodological approach involved an identification of farming practices that provide environmental public goods. Whilst a large number of practices could, in principle, contribute to the provision of public goods, an analysis was undertaken to identify those that provide particular environmental benefit.

A total of sixty-six agricultural practices were identified as being directly associated with providing one or a range of public goods. The farming practices were derived from a number of sources, including a literature review, the practices used in organic systems and those incorporated in agri-environment schemes, as well as information on regionally-specific practices from experts in eight case study regions. The list of practices was compiled by two independent agronomic and agri-environmental experts with pan-European knowledge.

Many practices provide more than one environmental public good, often to different degrees. Others may conflict with the supply of certain other public goods, for example, high milking frequency may enhance carbon efficiency in dairy production but be associated with intensive systems of little value in biodiversity terms. Many practices can occur in several different farming systems and contribute to a variety of public goods. The application of low levels of nitrogen fertiliser results both in improvements in water quality and a reduction in greenhouse gas emissions.

2 An identification of the farming systems with which individual practices are associated

Once a central list of 66 farming practices had been compiled, individual practices were assigned to the farming system with which they are associated, or potentially could be. Often a single practice will occur in more than one farming system.

3 Scoring of the practices for the extent to which they provide one or a range of public goods

Each farming practice, within the farming systems in which it occurs, was separately assessed by two experts[20] and assigned a score from 0 – 5[21], indicating the extent to which it provides each of the 10 public goods, on a typical farm of that system. The single score captures ***two*** combined elements:

i. The significance of the contribution of the practice to the provision of the public good; and

ii. The frequency with which the practice is likely to be undertaken in a particular farming system (this does not attempt to reflect how much of Europe's farmland is managed under that system).

The interpretation of this combined score is illustrated by the following two examples:

- On livestock farms, mowing grassland once late in the season supports farmland biodiversity, but it would achieve a higher score in extensive dairy systems, where the practice is common, than in intensive dairy systems where it is rare.

- The practice of retaining field boundaries makes a significant contribution to farmland biodiversity, and is common in extensive arable systems. It is therefore assigned a high score – 4 – for its contribution to farmland biodiversity under this farming system. However in intensive

[20] Against a defined counterfactual which is the most economically rational farming alternative which allows for positive returns while delivering minimum standards set out in cross-compliance, whether in the SMRs or GAEC. Non-farming alternatives are not considered, but may be significant in some circumstances.

[21] A score of 0 reflects a situation where a practice is theoretically possible but very unlikely to be found within that system (distinguishing it from a practice which is simply not applicable to that system), a score of 1 reflects a very low level of provision, and a score of 5 a very high level of provision.

arable systems, the retention of field boundaries also contributes to farmland biodiversity but the practice is less common, and hence a lower score – 1 is assigned for its contribution to farmland biodiversity in this farming system.

The resulting scores were then sent for validation and peer review to eight experts from other parts of the EU[22] with detailed knowledge of different farming systems, and where necessary, the scores were adjusted in light of their comments.

Analysis – Farming Practices

To assess the contribution of individual farming practices to the provision of a range of environmental public goods, we analysed the following:

1) The public goods provided by individual farming practices (Annex Table 3).

2) The number of public goods delivered by an individual farming practice and the number of farming systems within which each practice occurs, or has the potential to occur (Annex Figure 2).

Results – Farming Practices

The range of public goods provided, or potentially provided by individual farming practices is indicated in Annex Table 3. The public goods of farmland biodiversity, water quality, soil functionality and agricultural landscapes are maintained or enhanced by the largest number of practices - by 53, 43, 36 and 35 farming practices, respectively. Air quality and water availability are improved by only seven and nine practices, respectively, whilst reductions in GHG emissions, improved carbon storage, and improvements in the resilience to flooding and resilience to fire are supported by 22, 18, 17 and 12 practices, respectively.

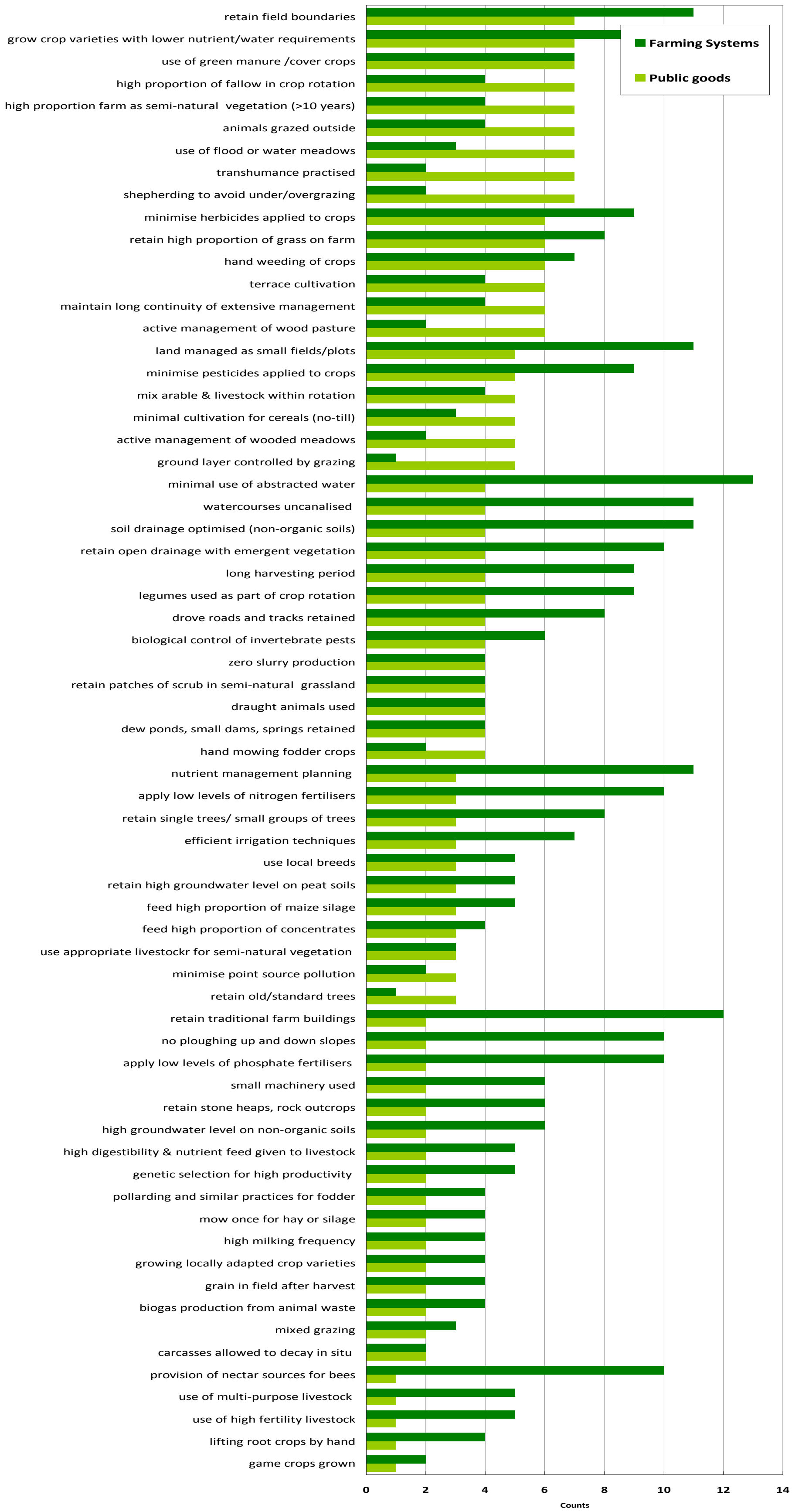
[22] The Netherlands, Spain, Czech Republic, Italy, France, UK, Greece and Malta.

Annex Table 3 The range of public goods provided by individual farming practices

	Agricultural landscapes	Farmland biodiversity	Water quality	Water availability	Soil functionality	Climate stability - carbon storage	Climate stability - GHG emissions	Air quality	Resilience to flooding	Resilience to fire
Retention of field boundaries	X	X	X	X	X	X			X	
Growing crop varieties with lower nutrient/water requirements	X	X	X	X	X	X			X	
The use of green manure / cover crops		X	X		X	X	X		X	
High proportion of fallow in rotation		X	X	X	X	X		X		X
High proportion of farm as permanent (>10 years) semi-natural vegetation	X	X	X		X	X			X	X
Animals grazed outside	X	X	X		X		X	X		X
The use of flood or water meadows	X	X	X		X	X	X		X	
Transhumance practiced	X	X		X	X	X			X	X
Shepherding of grazing on semi-natural habitats	X	X	X		X	X			X	X
Minimise herbicides applied to crops	X	X	X	X	X			X		
Retention of high proportion of grass on farm	X	X	X		X	X			X	
Hand weeding of crops	X	X	X		X		X	X		
Terrace cultivation	X	X	X		X	X			X	
Maintaining long continuity of extensive management	X	X	X		X				X	X
Active management of wood pasture	X	X			X	X			X	X
Land managed as small fields/plots	X	X	X		X				X	
Minimise pesticides applied to crops		X	X	X	X			X		
Mix arable and livestock within rotation	X	X	X		X					X
Minimal cultivation for cereals (no-till)			X	X	X	X	X			
Active management of wooded meadows	X	X	X			X				X
Ground layer controlled by grazing	X	X	X		X	X				
Minimal use of abstracted water	X	X	X	X						

Watercourses uncanalised	X	X	X						X	
Soil drainage optimised (non-organic soils)			X		X		X		X	
Retain open drainage with significant emergent / riparian vegetation	X	X	X						X	
Long harvesting period	X	X	X		X					
Legumes used as part of crop rotation		X	X		X		X			
Retention of drove roads and tracks	X		X						X	X
Biological control of invertebrate pests		X	X		X			X		
Zero slurry production			X		X		X	X		
Retention of patches of scrub within semi-natural grassland	X	X			X	X				
Use of draught animals	X	X			X		X			
Retention of dew ponds, small dams, spring fed water troughs	X	X							X	X
Hand mowing of fodder crops	X	X			X		X			
Nutrient management planning		X	X				X			
Application of low levels of N fertilizers		X	X				X			
Retention of single / small groups of trees	X	X				X				
Efficient irrigation techniques			X	X	X					
Use of local breeds	X	X			X					
High groundwater level retained on peat soils		X	X				X			
Feed - high proportion of maize silage			X		X		X			
Feed - high proportion of concentrates			X		X		X			
Use livestock appropriate for semi-natural grazing	X	X								X
Minimise point source pollution		X	X			X				
Retention of old/standard trees	X	X				X				
Retention of traditional farm buildings	X	X								
No ploughing up and down slopes			X		X					
Application of low levels of P fertilisers		X	X							
Small machinery used		X			X					
Retain stone heaps, rock outcrops	X	X								
High groundwater level retained on non-organic soils		X	X							
High digestibility and high nutrient content feed given to livestock			X				X			

Genetic selection for high productivity		X					X			
Pollarding *etc* for fodder	X	X								
Single mowing for hay or silage		X			X					
High milking frequency		X					X			
Growing locally adapted crop varieties	X	X								
Grain left in field after harvest		X	X							
Biogas production from animal waste			X				X			
Mixed grazing	X	X								
Carcasses allowed to decay in situ		X	X							
Availability of nectar sources for bees		X								
Use of multi-purpose livestock							X			
Use of high fertility livestock							X			
Lifting root crops by hand					X					
Growth of game crops		X								



Annex Figure 2 The number of public goods provided by each farming practice, and the number of farming systems within which each practice occurs, or has the potential to occur

Annex Table 3 by providing an overview of the number of public goods which are delivered by each farming practice (light green bar). The figure is based on the full set of 13 farming systems, and the maximum possible value is 10, if the practice provides all 10 public goods, and the minimum possible value is one, if the practice provides just one public good. Practices that do not provide any public goods are not included in this assessment. In addition, Annex Figure 2 indicates the number of farming systems within which each practice occurs (dark green bar), or has the potential to occur. The maximum possible value is 13 if the practice occurs in all 13 farming systems, and the minimum is one if the practice occurs in just one farming system.

Farming practices that provide a wide range of public goods

21 farming practices were recorded as providing five or more public goods. Of these, nine practices were recorded as each providing seven public goods (these practices are clustered at the top of Annex Figure 2).

Eight of the 21 farming practices were also recorded as occurring in seven or more farming systems. These practices were: retention of field boundaries, growing crops with lower nutrient / water requirements, the use of green manure and/or cover crops, minimal applications of herbicides to crops, retention of high proportion of grass in the farm area, hand weeding of crops, land managed as small fields or plots and minimal applications of pesticides to crops. These eight practices may thus be seen as those that currently are particularly beneficial for providing public goods from agriculture in Europe. This is because they each have the potential to provide five or more public goods and to occur across a wide range of farming systems.

Farming practices that provide a smaller range of public goods

The overall extent of the provision of public goods by individual farm practices is summarised in Annex Figure 2. This indicates that 45 per cent of practices were recorded as occurring, or potentially occurring in six or fewer farming systems and supporting less than five public goods each. Just over 22 percent of farming practices were widespread but supported less than five public goods each. These public goods tended to be agricultural landscapes, farmland biodiversity, water quality, soil functionality and greenhouse gas emissions.

Annex Table 4 **Summary of the extent of provision of public goods by individual farming practices**

	Number of practices occurring in ≤6 farming systems	Number of practices occurring in ≥7 farming systems
Number of practices supporting <5 public goods	**30**	**15**
Number of practices supporting ≥5 public goods	**13**	**8**

Discussion

This list of beneficial farming practices is not exhaustive but it demonstrates the considerable range of practices involved, both in the crop and livestock sectors, and their varied importance, or potential importance, in providing public goods. Overall, relatively few practices appear to provide public goods at a large scale, in other words, to provide a wide range of public goods over a wide area in a sizeable range of farming systems. Such a result emphasises the importance of maintaining a diversity of farming systems that include a broad range of farming practices in order to maximise the delivery of public goods from agriculture in the EU. This inventory of beneficial farming practices will change over time as emerging technologies provide new possibilities, for example, novel ways of improving energy efficiency, and enhancing the environmental value of existing specific practices.

Analysis – Farming Systems

To assess the contribution of farming systems to the provision of a range of environmental public goods, we analysed the following:

1) The number of farming practices found in each farming system that provide public goods – Annex Figure 3.

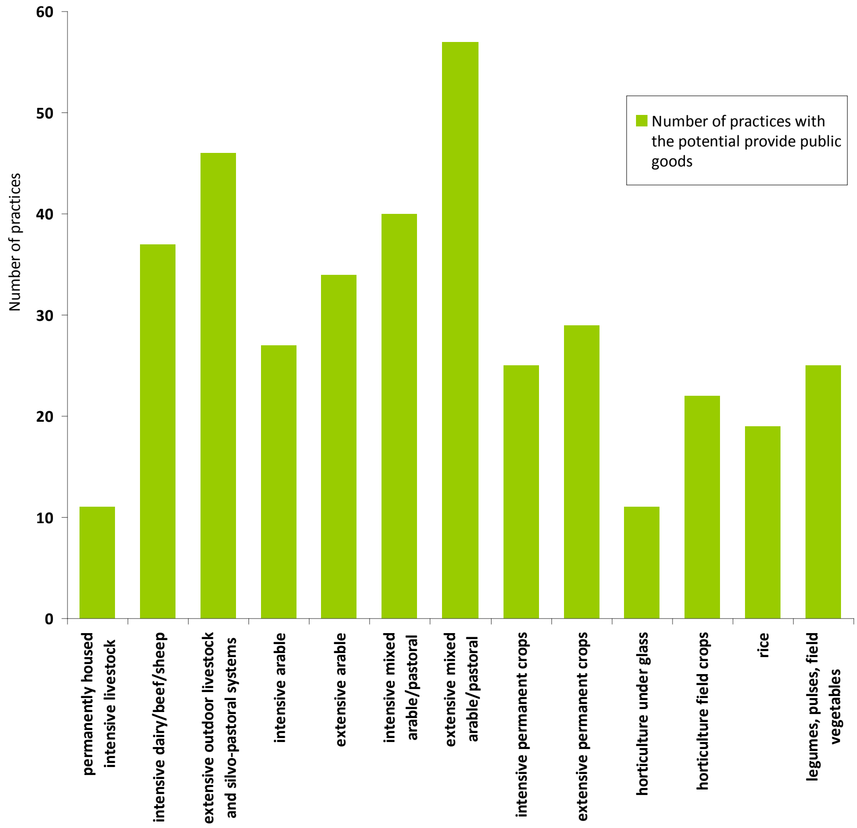
2) The number of practices within each farming system providing individual public goods – Annex Table 5.

3) The number of farming practices within each farming system that provide a high level of benefit for individual public goods – Annex Table 6.

Results – Farming Systems

The potential of different farming systems to provide public goods

The number of 'beneficial' farming practices associated with each of the 13 farming systems is shown in Annex Figure 3. This histogram provides an indication of the potential of different farming systems to provide public goods. It is evident that extensive mixed arable/pastoral and extensive outdoor livestock and silvo-pastoral systems have the largest number of beneficial practices associated with them. Intensive mixed arable/pastoral and intensive dairy/beef/sheep also have a large number of practices associated with them, but the majority of these are considered to provide only a low level of provision (expert score < 3) of the associated public goods (see Annex Table 6). Overall, extensive systems have more practices associated with them than their intensive counterparts (compare intensive *vs.* extensive arable in Annex Figure 3, for example), and farming systems involving grazing livestock (that is mixed and livestock systems) have more beneficial practices associated with them than cropping only systems.



Annex Figure 3 **Number of farming practices in each farming system that provide public goods**

The range of public goods provided by different farming systems

The number of practices that are associated with the provision of each public good within each farming system is shown in Annex Table 5. From this Table it is evident that, in addition to being associated with more practices overall, in general extensive systems tend to have more practices providing individual public goods than their intensive counterparts. For example, the extensive mixed arable/pastoral system is recorded as having 57 beneficial practices overall, with 27 contributing to agricultural landscapes, 42 to farmland biodiversity, 24 to soil functionality and 30 to water quality. By contrast, the intensive mixed arable/pastoral system is recorded as having 40 beneficial practices overall, with 12 contributing to valued agricultural landscapes, 20 to farmland biodiversity, 10 to soil functionality and 22 to water quality.

Of the 13 farming systems, extensive mixed arable/pastoral and extensive outdoor livestock and silvo-pastoral systems have the largest number of beneficial farming practices across the largest range of public goods. Both systems are considered to provide all 10 public goods (Annex Table 5) and to make a significant contribution to four and three public goods, respectively.

Among the intensive farming systems, those with grazing livestock, notably intensive mixed arable/pastoral and intensive dairy/beef/sheep, are associated with more practices providing to individual public goods than intensive farming systems with crops alone. Permanently housed intensive livestock and horticulture under glass are considered as making the smallest contribution to public goods. They provide six and seven public goods, respectively, with usually fewer than 10 farming practices contributing to each public good, and each practice usually makes a small contribution (Annex Table 6). All of the remaining farming systems provide nine or 10 public goods, but the number of practices and the size of the contribution (as measured by the expert score) tends to be lower in the intensive farming systems than in the extensive systems (Annex Table 6).

Annex Table 5 **The number of practices providing each public good within each farming system**

Farming System	Total number of practices occurring	Agricultural landscapes	Farmland biodiversity	Water quality	Water availability	Soil functionality	Climate stability – carbon storage	Climate stability – reduced GHG emissions	Air quality	Resilience to flooding	Resilience to fire
Permanently housed intensive livestock	11	1	2	2	1	0	1	8	0	0	0
Intensive dairy/beef/sheep	37	14	21	18	1	13	6	16	2	6	1
Extensive outdoor livestock and silvo-pastoral systems	46	24	31	18	1	17	7	16	2	11	8
Intensive arable	27	10	19	16	7	9	6	6	2	4	0
Extensive arable	34	13	24	19	2	15	5	8	5	8	3
Intensive mixed arable/pastoral	40	12	20	22	3	10	4	16	4	4	1
Extensive mixed arable/pastoral	57	27	42	30	4	24	9	15	5	11	8
Intensive permanent crops	25	8	16	9	3	11	5	4	4	6	0
Extensive permanent crops	29	19	25	11	3	12	5	3	4	3	1
Horticulture under glass	11	0	3	10	3	4	0	4	4	1	0
Horticulture field crops	22	7	10	14	3	12	2	4	2	4	0
Rice	19	8	16	9	2	10	1	4	3	2	0
Legumes, pulses, field vegetables	25	6	12	15	3	10	3	5	4	4	0

Key

	10 – 19 high-scoring practices
	20+ high-scoring practices

The relative provision of public goods by farming system

Annex Table 6 indicates, for each environmental public good, the number of practices within each farming system that provide a high level of benefit, as measured by the size of the scores assigned by all ten experts. Farming practices that score 3 or more are considered to deliver a high level of benefit, whilst those that score less than 3 are considered to deliver a low level of benefit, within the parameters of this exercise.

Annex Table 6 **The number of high-scoring practices (expert score ≥3) providing each public good within each farming system**

Farming System	Ttotal number of practices occurring	Agricultural landscapes	Farmland biodiversity	Water quality	Water availability	Soil functionality	Climate stability – carbon storage	Climate stability – reduced GHG emissions	Air quality	Resilience to flooding	Resilience to fire
Permanently housed intensive livestock	11	0	0	0	0	0	0	7	0	0	0
Intensive dairy/beef/sheep	37	4	5	4	1	5	1	10	0	4	0
Extensive outdoor livestock and silvo-pastoral systems	46	20	29	8	1	10	5	5	2	6	6
Intensive arable	27	0	2	3	4	2	0	2	0	1	0
Extensive arable	34	10	20	8	2	8	3	4	3	4	1
Intensive mixed arable/pastoral	40	5	7	6	1	6	0	9	0	1	0
Extensive mixed arable/pastoral	57	21	32	11	2	13	4	8	5	4	5
Intensive permanent crops	25	0	0	0	0	1	0	1	0	1	0
Extensive permanent crops	29	10	17	7	1	6	0	1	2	3	0
Horticulture under glass	11	0	0	3	1	1	0	2	0	1	0
Horticulture field crops	22	1	1	3	0	2	0	2	0	1	0
Rice	19	4	9	8	1	4	1	1	0	0	0
Legumes, pulses, field vegetables	25	0	4	6	1	1	0	4	0	1	0

Key

(light shading)	10 – 19 high-scoring practices
(dark shading)	20+ high-scoring practices

Across the 10 public goods and 13 farming systems, the largest number of high-scoring practices contributes to the provision of farmland biodiversity and improved water quality. Soil functionality, agricultural landscapes and reduced greenhouse gas emissions are also supported by a large number of high-scoring practices (Annex Table 6). Only six of the 13 farming systems are associated with practices that improve resilience to fire and the majority of these are considered to play a limited role. In part, this is because fire hazard tends to be limited geographically (being particularly prevalent in the Mediterranean region), however, it is notable that fewer than 10 practices contribute to fire resilience in each of the relevant farming systems. There are practices that contribute to air quality, carbon storage, water availability and resilience to flooding to a limited degree in most farming systems, but the number of contributory practices is usually less than 10 (Annex Table 6).

Conclusions

These analyses suggest that in general extensive farming systems are associated with a larger number of farming practices providing a greater range of environmental public goods, compared to intensive farming systems, although this will depend on geographic location and local conditions. The occurrence of grazing livestock within a system, both extensive and more intensive systems, is also seen to be important for enhancing its contribution to public goods. It is also evident that within all farming systems, the scale of public goods provision is uneven.

ANNEX III EVIDENCE FOR THE SCALE OF DEMAND FOR AND TRENDSIN THE PROVISION OF ENVIRONMENTAL PUBLIC GOODS

This Annex sets out a range of evidence for the scale of demand for environmental public goods as well as data on trends relating to their ongoing provision and condition. Evidence of the scale of demand is based on Eurobarometer data portraying the attitudes of European citizens to various aspects of the environment. An overview of the current provision of public goods through agriculture at EU level is derived from an examination of relevant state of the environment indicators.

The Scale of Demand for Environmental Public Goods

The following table sets out evidence for the scale of demand for environmental public goods based on the Eurobarometer State of the Environment Survey conducted in 2009 (DG Communication, 2009a).

Annex Table 7 Attitudes of surveyed European citizens towards the environment, 2009

Answer	EU-27	CZ	DE	ES	FR	IT	RO	SW	UK
What do you think are the most important issues facing (OUR COUNTRY) at the moment? (two answers chosen from a list of 11 categories allowed) (%)									
Protecting the environment	4	2	3	2	7	2	3	16	4
Economic situation	47	51	49	48	40	43	48	52	46
Unemployment	45	46	42	62	54	37	28	53	44
Energy related issues	4	9	7	1	3	2	2	11	3
How important is protecting the environment to you personally?									
Very important	64	63	56	63	79	64	49	89	65
Fairly important	32	35	40	33	20	32	41	10	29
When people talk about "the environment", which of the following do you think of first? (%)									
Pollution in towns and cities	22		12	28	19	36	24	7	28
Climate change	19		28	22	18	9	8	39	26
Green and pleasant landscapes	13		6	17	6	15	15	13	8
Protecting nature	12		16	6	13	11	16	4	5
The state of the environment our children will inherit	12		16	3	20	7	11	20	15
The quality of life where you live	5		5	3	4	5	7	1	5

Answer	EU-27	CZ	DE	ES	FR	IT	RO	SW	UK
Using up natural resources	3		3	4	5	3	1	3	3
From the following list, please pick the five main environmental issues that you are worried about? (%)									
Climate change	57		65	57	59	47	57	71	53
Water pollution	42		40	38	46	35	45	52	35
Air pollution	40		36	34	43	39	46	35	42
Man made disasters	39		44	31	43	39	35	41	28
The impact on our health of chemicals used in every day products	32		33	20	33	31	36	26	37
Depletion of natural resources	26		30	25	37	21	17	31	27
Growing waste	24		19	7	27	18	19	17	36
Loss in biodiversity (extinction of species, loss of wildlife and habitats)	23		29	22	25	17	17	34	20
Agricultural pollution (use of pesticides, fertilizers, etc.)	23		19	21	30	26	27	18	18
The use of genetically modified organisms in farming	20		27	13	20	20	22	20	
Urban problems (traffic jams, pollution, lack of green spaces, etc.)	15		11	11	11	17	19	8	20
Impact of current transport modes (more cars, more motorways, more air traffic, etc.)	12		16	3	14	8	10	29	15
Our consumption habits	11		12	6	15	8	10	25	14
Noise pollution	8		8	6	5	3	9	1	14
European environmental legislation is necessary for protecting the environment in (OUR COUNTRY)(%)									
Agree	82		86	80	88	82	85	80	70
In your opinion, is the EU currently doing too much, doing about the right amount, or not doing enough to fight climate change (%)									
Too much	3	3	3	3	2	2	2	1	4
About right amount	25	36	37	19	16	20	24	18	25
Not enough	58	50	53	59	71	63	51	73	49
The EU should allocate more money to the protection of environment, even if this means that less money is spent on other areas (%)									
Agree	78		78	79	79	73	81	89	71
Have you done any of the following during the past month for environmental reasons? (chosen from a list of nine categories) (%)									
Chosen locally	21		29	12	20	17	11	32	30

Answer	EU-27	CZ	DE	ES	FR	IT	RO	SW	UK
produced products or groceries									
Bought environmentally friendly products marked with an environmental label	17		18	11	19	11	21	42	23
In general, how informed do you feel about environmental issues? (%)									
Informed (very and fairy well)	55	40	65	45	61	42	30	70	70

Source: Special Eurobarometer Report '*The Europeans in 2009'.* Fieldwork: January – February 2009 Publication: July 2009. Available at: http://ec.europa.eu/public_opinion/archives/eb_special_en.htm. The information is based on sample survey data collected in 2007 using a random sample proportional to the size of the country population across all 27 Member States.

Trends in the Provision of Environmental Public Goods

Data relating to relevant state of the environment indicators have been examined to provide information on the current provision of public goods through agriculture and to provide an overview at EU level. The text accompanies Table 4.1 in Chapter 4 of the report. Indicators on the state of Europe's environment have been developed under a number of guises, including, for example, the IRENA operation (EEA, 2005d), the SEBI 2010 process (EEA *et al.*, 2009b), the Sustainable Development Indicators (Eurostat 2007), the Common Monitoring and Evaluation Framework (CMEF) for the rural development programmes 2007–2013 and through the work of the OECD (NIJOS and OECD 2002; OECD 2008). In Annex Table 19, we provide selected examples of datasets which provide information on the current provision of public goods at the national scale.

Agricultural Landscapes

Agricultural landscapes are defined and influenced by the interaction of a range of factors, including cropping and stocking patterns, the intensity of land use, parcel sizes and boundaries, unfarmed features and cultural aspects. There is no single indicator that currently exists that can act as a proxy for these factors in combination and that reflect the complexity and multiple functions of the EU's agricultural landscapes (EEA, 2005f). The indicators in Annex Table 8 encompass a variety of factors that influence the character of agricultural landscapes, including crop area, livestock density, land cover and the occurrence and spatial distribution of crop types and linear features.

Annex Table 8 Indicators relating to Agricultural Landscapes

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Cropping / livestock patterns (EEA), livestock density index (Eurostat)	IRENA[1] 13 SDI[2]	↓	-	The proportion of permanent grassland in areas where this land use is dominant (mainly in the western EU-15) has decreased overall since 1990, with the exception of Spain. Decreases of >25% were reported in Denmark, central and western France (EEA, 2005b). At the EU level, the number of livestock units per hectare of UAA declined on average by 1.1% per annum between 2000 and 2005 in the EU-15. Cattle had the highest share of the total livestock population in many regions in 2000, but declined by more than 10% in many cattle-dominated areas (EEA, 2005b).
Land cover change	IRENA 24, CMEF[3] baseline indicator for context 7, EEA[4]	?	?	IRENA 24 identifies land cover changes to and from forest/semi-natural and agricultural land. For the period 1990-2000, change was most dynamic in Spain (from forest to agriculture), whereas in Italy and Portugal change was from agriculture to forest/semi-natural land.
Intensification / extensification (EEA), Area under extensive agriculture (EAFRD)	IRENA 15 CMEF baseline indicator for context 9	↑*	+	In 1990, 44% of the agricultural area of the EU-12 was managed by high-input farms, but this has decreased to 37% in 2000. Low input farms occupied the lowest share of the agricultural area in 1990 (26%), but this share increased to 28% in 2000 (EEA, 2005g). * Relates to low input farms
Landscape state (EEA) / ecosystem (habitat) diversity (OECD)	IRENA 32, OECD[5] agri-environmental indicator viii	?	?	IRENA 32 indicates the importance of agriculture in terms of land cover in selected landscape types. Agricultural land is dominant in the bocage (hedgerow) landscapes (84% of

				total land area) and least dominant in the alpine (24% of total land area) case study areas (EEA 2005f).
Landscape	IRENA 35, OECD agri-environmental indicator x	↑↓	+/-	From 1990-2000 grasslands increased by 10% in the Mediterranean open field region of Castilla y León. Conversely, it decreased by 10% in the Atlantic bocage region of Normandy. The area of permanent crops decreased by 5% in the Montado case study region of Portugal. (EEA 2005h).
Farmland Features and habitats	Farmer *et al.*, 2008	↑↓	+/-	6 national surveys were identified: Countryside Survey, Centre for Ecology & Hydrology, UK; NILS database, SLU-Umea, Sweden; SINUS, University of Vienna / Umweltbundesamt, Austria; SISPARES UPM Madrid, INIA, Spain; Steekproef Landschp, Alterra, the Netherlands; Alterra + KVL project database, Alterra NL & KU Denmark; and a number of case studies show both increases and decreases within Member States.

Sources:
[1]IRENA indicators from European Environment Agency (EEA, 2005 a-r)
[2]SDI - Sustainable Development Indicator, Eurostat (2007)
[3]CMEF Objective related Baseline Indicators, EAFRD
[4]EEA (2006b) Land accounts for Europe 1990-2000. EEA report no. 11/2006
[5]OECD agri-environmental indicators of regional importance and/or under development

Grazing by livestock has created the landscape and habitat diversity characteristic of extensive pastoral farming systems in Europe, and is particularly prevalent in areas unsuitable for arable cultivation, including marginal and mountainous areas. A decline in livestock, especially cattle and sheep, can lead to the degradation in the character of these valued agricultural landscapes. The intensification of livestock farming by increasing stocking densities, the use of bought in feedstuffs and increased stabling of cattle, for example, also exerts pressure on agricultural landscapes, and this is the case in many grassland areas, especially in the dairy systems of north-western Europe. Mosaics of grassland and arable crops in northern EU countries, or of arable and permanent crops in the Mediterranean region, provide an important contribution to the character of the landscape and habitat diversity.

A study undertaken for DG Environment demonstrated that, at the European level, there is a significant gap in the available data on the distribution, density and diversity of farmland features and habitats (Farmer *et al.*, 2008). Results from national databases in six Member States (Sweden, Austria, Spain, The Netherlands, Denmark and the UK – see Annex Table 8) presented a mixed picture in terms of trends, with both declines and increases recorded within different regions of the same country in Austria and Great Britain. These trends were context specific and resulted from different pressures and policy contexts (Jongman and Bunce (2008) quoted in Farmer *et al.*, 2008).

Farmland Biodiversity

Indicators relating to farmland biodiversity include direct measures of trends in species populations, animal breeds and status of protected areas, as well as indirect parameters, such as the use of pesticides – which can have an affect on species and genetic diversity - and assessments of the impacts of agricultural practices on habitats and biodiversity (Annex Table 9).

Annex Table 9 Indicators relating to farmland biodiversity

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Population of farmland birds	Farmland bird population index[6], SEBI[7] 1a, IRENA 28, CMEF Baseline indicator 17	↓(=)	-	Since 1990, the index is based on data from the EU-15 MS except FR, GR, LU, PT (EEA 2006a). Population trends in 23 farmland bird species are measured. Farmland bird populations declined by over one third (on average) between 1980 and 2002 with the steepest decrease in the 1980s, and a smaller but more stable since decline 1990. The countries most affected are BE, FR, NL, SE and the UK. Large variation occurs both within and between countries.
Grassland butterflies	Butterfly Conservation Europe, SEBI 1b	↓	-	Grassland habitats at risk of abandonment or intensification.
Conservation status of Natura 2000 farmland habitats	SEBI 7 & 8; IRENA 4, CMEF baseline indicator for context 10	↓	-	Approximately 18% of the habitats in Natura 2000 areas depend on a continuation of extensive agricultural practices (EEA 2006a).

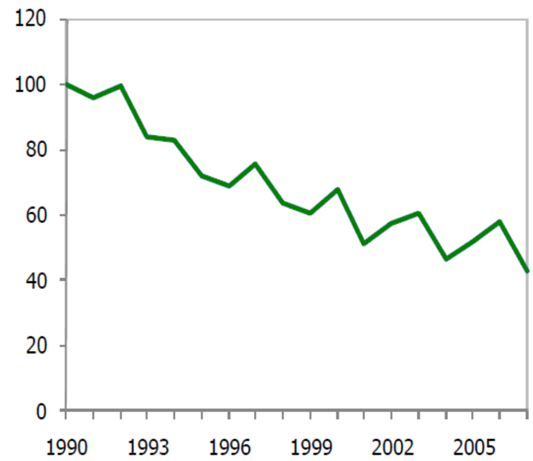
Livestock genetic diversity	SEBI 6, IRENA 25	=	=	There is no overall agreement among countries on the definition of 'native' and 'non-native' breeds. Populations of native breeds remain in critically low numbers and make up only a small part of the total population. Data are available for only a few countries, but these indicate that many native cattle breeds are endangered and the situation for sheep is also problematic. Overall, the situation is stable (EEA 2009e).
Consumption of pesticides	IRENA 9	↑	-	Total estimated amount of pesticides used in agriculture increased by 20% between 1992 and 1999 (ECPA data).
Impact of agricultural practices on habitats and biodiversity	IRENA 33	↓	-	IRENA 33 analyses agricultural impacts on Important Bird Areas (IBAs) and on Prime Butterfly Areas (PBAs) on the basis of case studies. It shows that 92% of all target butterfly species in Europe depend on agricultural habitats (extensive grasslands). Their conservation status is generally negative throughout the EU-15, apart from Spain and Greece. 80% of all agricultural PBAs experience negative impacts from intensification, abandonment or both. 43% of all agricultural sites suffer from intensification, whereas abandonment is a significant problem in 47% of sites. Both impacts occur simultaneously in 10% of sites.

Sources:
[6]Common Birds Indicator from Pan-European Common Bird Monitoring Project of European Bird Census Council (EBCC) / RSPB / Birdlife International / Statistics Netherlands
[7]SEBI 2010 indicators, European Environment Agency (2009b)

Farmland Species

Reliable EU data are available on bird populations and the farmland bird index has been formally adopted by the EU as a one of the structural indicators for Europe, used to underpin annual assessments of the progress made towards the Lisbon objectives, and is also one of seven CMEF impact indicators to assess the impacts of rural development programmes on the Community's strategic objectives for rural development.

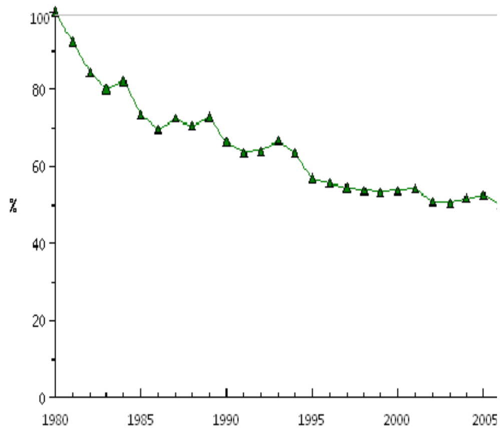
The pan-European Common Bird Indicator shows average trends in population sizes of a suite of common breeding birds across European countries. As shown in Annex Figure 4, there has been a downward trend in farmland birds in Europe with a decline in the indicator of more than 40 per cent since 1980, most likely to be linked to changes in agricultural practices, such as increases in intensive farming practices and a reduction in traditional farming methods. Set-aside has been shown to benefit farmland bird populations in the UK, Germany, Sweden, France and Ireland, and the cessation of compulsory set-aside may have a negative impact on farmland bird populations (IEEP, 2008). Stubble fields left after harvesting of cereal crops in the autumn provide an important food source for granivorous farmland birds such as skylark, corn bunting, yellow hammer and linnet and their occurrence (except in set-aside cereal fields) is now extremely low in most lowland arable farming areas due to an increase in winter sowing. In a study on the use of set-aside by birds in winter, five out of six declining farmland bird species were found in significantly greater numbers on set-aside than would be expected if birds were randomly distributed over the farmland landscape (Buckingham *et al*., 1999).



European grassland butterfly indicator 1990-2005

Source: Butterfly Conservation Europe/Statistics Netherlands (Van Swaay and Van Strien, 2008)

Note: Population trends are shown as a percentage change in relation to a baseline figure in 1990.



Common farmland bird indicator 1980-2006

Source: EBCC/RSPB/BirdLife/Statistics Netherlands (2009)

Note: Population trends are shown as a percentage change in relation to a baseline figure in 1980.

Annex Figure 4 Population trends of grassland butterflies since 1990 and common farmland birds since 1980

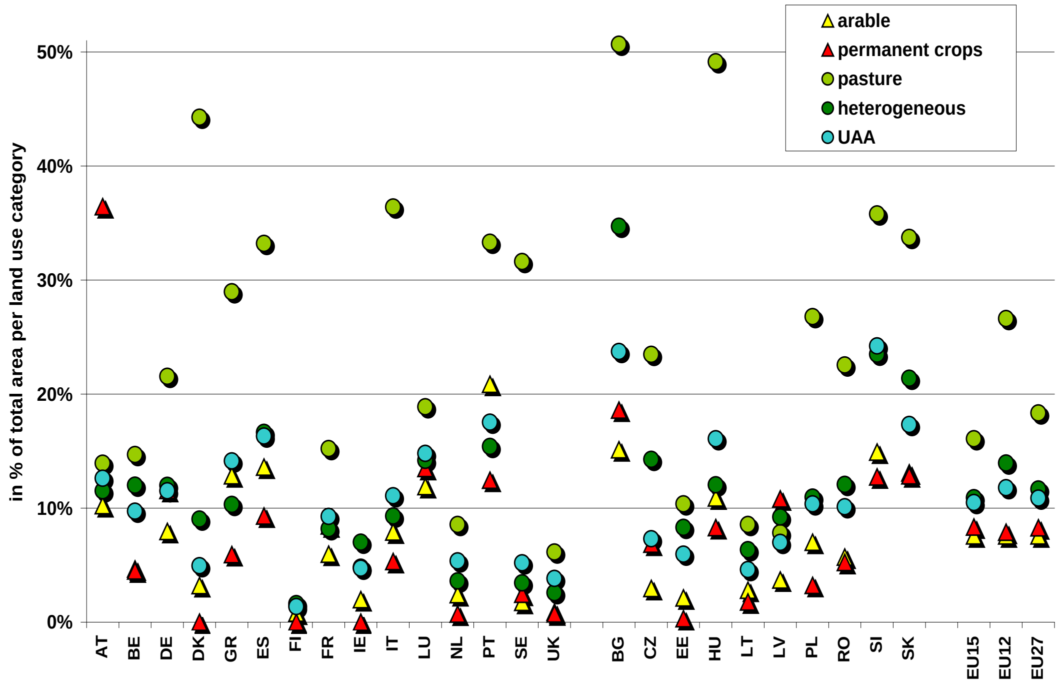
The European Grassland Butterfly Indicator shows the population trend of butterflies which are characteristic of grasslands in the investigated countries in Europe[23]. As Annex Figure 4 shows, since 1990, the trend is negative and has declined by almost 60 per cent, notwithstanding the small annual variations mainly caused by weather effects. Grassland butterflies depend on the continuation of active grassland management by humans or livestock to provide habitats that are suitable for breeding. The main driver behind the decline is thought to be the loss of extensively managed grassland (Annex Figure 9) due to agricultural intensification or, in some regions (such as more remote mountain areas), land abandonment. When land use is intensified, host plants often disappear or the management becomes unsuitable for larval survival. Where land is abandoned, the grassland quickly becomes tall and rank and is soon replaced by scrub and eventually woodland (van Swaay and van Strien, 2008).

The genetic diversity of domesticated species is also an important component of farmland biodiversity. Native breeds may be less productive than highly specialised breeds, but they are generally well adapted to local conditions and semi-natural habitats and play an important role in maintaining the diversity of the latter as well as being an important source of genetic variability for future breeding programmes (EEA, 2009b). Although data are available for only some Member States, the status of livestock genetic diversity in the EU is highly variable across countries and between cattle and sheep. An increase in the proportion of introduced (non-native) breeds shows a trend towards a homogenisation of the genetic pool across European countries, with widespread use of the same highly productive breeds.

Farmland Habitats

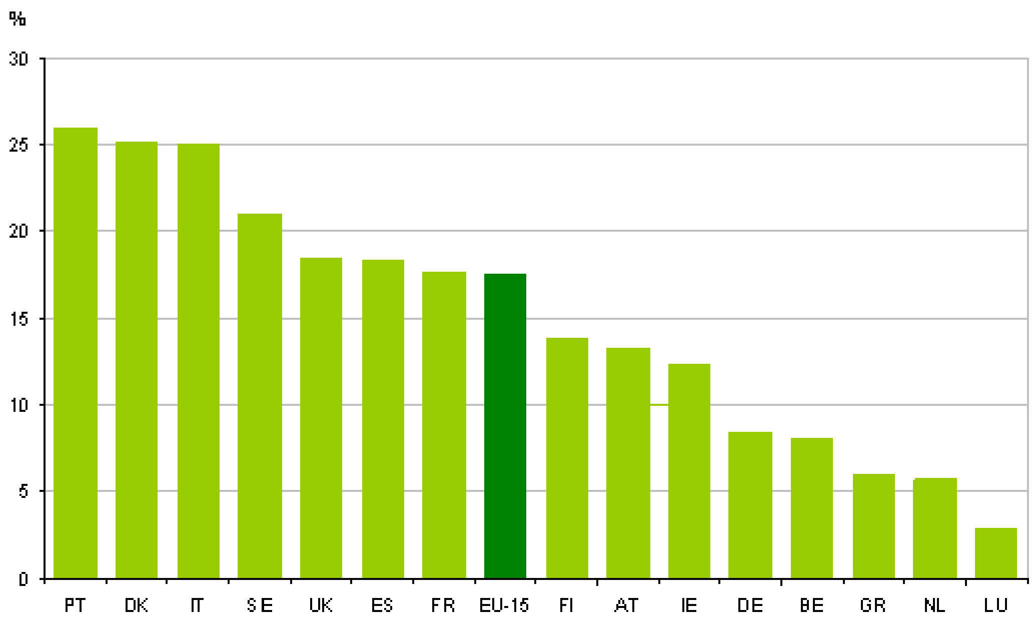
Annex Figure 5 shows that pasture is the dominant agricultural land use within Natura 2000 areas, and also shows that a high proportion of the total area of pasture in the EU-27 is in Natura 2000 areas compared to the proportion of arable land or permanent crops. In some Member States, as much as 25 per cent of the total area of Natura 2000 sites is covered by habitats under Annex 1 of the Habitats Directive (92/43/EEC) that depend on a continuation of extensive farming (see Annex Figure 6). Although the data afford only a snapshot of the situation in 2005, it gives an indication of the distribution of habitats across the EU-15 Member States that are maintained by extensive farming practices (EEA, 2005a). The habitat types are listed in Annex Table 10. The loss of extensive farming practices – either to intensification or to land abandonment has had negative impacts on both habitats and their associated species. Less than 10 per cent of Annex 1 grassland habitats and less than 20 per cent of Annex 1 heath and scrubland habitats are in favourable status (EEA, 2009b).

[23] The indicator is based on data from 14 national Butterfly Monitoring Schemes within Europe.



Annex Figure 5 **Proportion of agricultural land use categories in Natura 2000areas by Member State**

Source: Natura2000 data base (European Commission, DG Environment), Corine Landcover 2000, own calculations.



Annex Figure 6 **The relative area of Natura 2000 sites covered by Annex I habitats that depend on a continuation of extensive farming practices**

Source: EEA, 2005a. Snapshot March 2005.

Annex Table 10 Habitat types threatened by abandonment of extensive agricultural practices or by intensification of pastoral activities

Habitat Code	Annex I habitat type threatened by either abandonment of extensive agricultural practices or by intensification of pastoral activities
1330	Atlantic salt meadows
1340	Inland salt meadows
1530	Pannonic salt steppes and salt marshes
2340	Pannonic inland dunes
4030	European dry heaths
4060	Alpine and boreal heaths
4070	Bushes with Pinus mugo and Rhododendron hirsutum
5130	Juniperus communis formations on heaths or calcareous grasslands
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi
6140	Siliceous Pyrenean festuca eskia grasslands
6160	Oro-Iberian festuca indigesta grasslands
6170	Alpine and subalpine calcareous grasslands
6180	Macaronesian mesophile grasslands
6210	Semi natural dry grasslands and scrubland facies on calcareous substrates
6220	Pseudo steppe with grasses and annuals of the Thero-Brachypodieta
6230	Species rich Nardus grasslands on siliceous substrates in mountain areas (and submontane areas in continental Europe
6240	Sub-continental steppic grasslands
6250	Pannonic steppes
6270	Fennoscandian lowland species rich dry mesic grassland
6310	Dehesas with evergreen Quercus spp.
6410	Molinia meadows on calcareous, peaty or clavey-silt-laden soils (Molinion caeruleae)
6420	Mediterranean tall humid grassland of the Molinio-Holoschoenion
6440	Alluvial meadows of river valleys of the Cnidion dubii
6450	Northern boreal alluvial meadows
6510	Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis)
6520	Mountain hay meadows
6530	Fennoscandian wooded meadows
7140	Transition mires and quaking bogs
7230	Alkaline fens
8240	Limestone pavements
9070	Fennoscandian wooded pastures
9260	Castanea sativa woods

Source: EEA, 2005a. Snapshot March 2005.

Water Quality

Indicators relating to water quality focus on nutrient load (specifically nitrogen and phosphorus) and pesticide contamination (Annex Table 11). Consumption of mineral fertiliser also provides an indirect measure of the potential for diffuse pollution and, as such, can be used as to indicate levels of water pollution from farmland (EEA, 2005i). An increase in nitrate levels in water bodies can cause eutrophication, lead to toxic algal blooms and a decline in fish and other aquatic organisms.

Annex Table 11 Indicators relating to water quality

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Nitrate and pesticide contamination	IRENA 30.1 & 30.2, CMEF baseline indicator 21	=/?	=/?	Nitrate levels are declining, although absolute values vary and data are incomplete. Pesticide consumption ↓ in EU-15 from 1990-1998, unchanged in EU-12.
Mineral fertiliser consumption	IRENA 8, FAOstat	↑↓	+/-	Total nitrogen (N) mineral fertiliser consumption in EU-15 decreased by 12% from 1990–2001. Total phosphate (P_2O_5) mineral fertiliser consumption in EU-15 decreased by 35% from 1990–2001 (average). Decreased in EU-15, except in ES and IE. Use of P and N fertiliser in EU-15 > EU 12.
Share of agriculture in nitrate contamination	IRENA 34.2	?	?	Data are available for 1995 (EEA 2005j). For the nine EU-15 MS that provided data, the weighted average share of agriculture in nitrate contamination is 56%. At the national level, the average ranges from 37% in Finland to 81% in Denmark. There is insufficient data for other years to analyse time series changes.

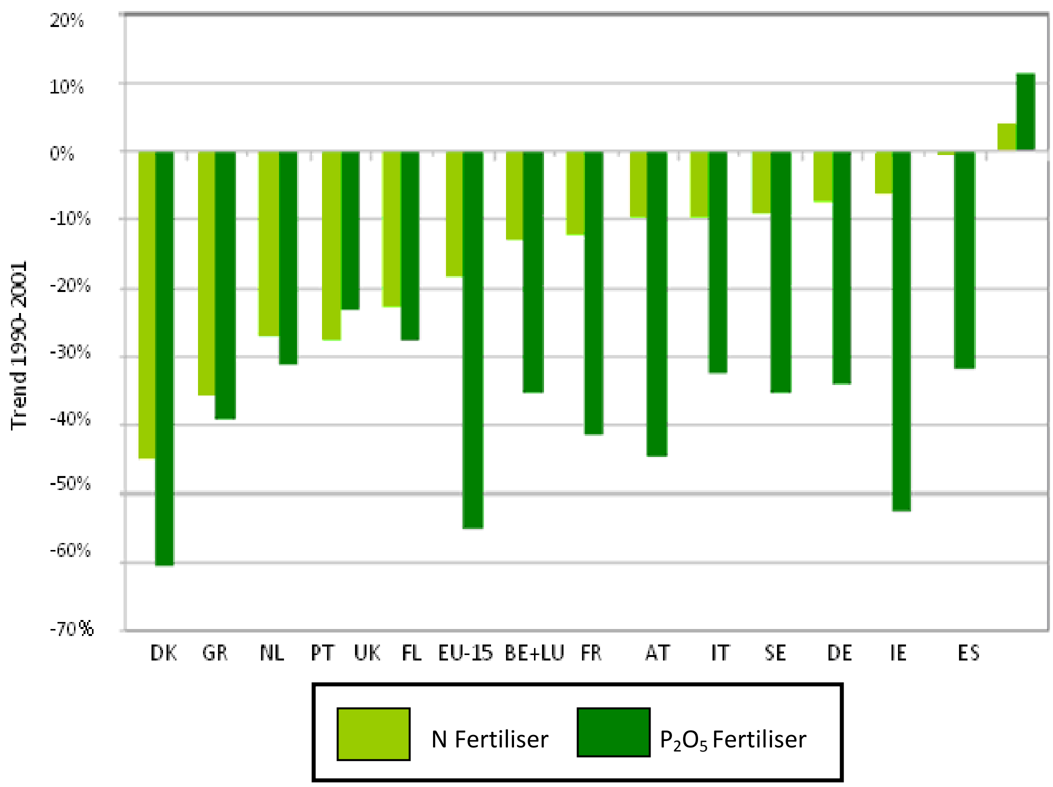
Nitrate and Pesticide Contamination of Surface and Groundwater

Information used to measure the trends in the indicator relating to nitrate concentrations is based on data collected from 289 ground water bodies in 14 Member States. The number of ground water bodies sampled in each MS varies considerably - for example only one body is sampled in Belgium - and hence the results are grouped into three regions: southern, northern and western central Europe. The average trend across the 14 Member States suggests an overall decline in nitrate concentration, but this result is strongly influenced by data from southern Europe, where nitrate concentration have declined from 40 to 25 mg NO_3/l. In the remaining two regions, concentrations have remained more or less stable (Annex Table 11) since 1993 at 20 mg NO_3/l, and 10 mg NO_3/l for western central and southern Europe respectively. However, delays in the transfer of nitrate from soil to water (which vary according to the underlying geology) could mask these concentration levels (EEA, 2005i). The EU Nitrates Directive (91/976/EEC) specifies a maximum concentration of 50 mg NO_3/l.

There are limited data on pesticides in ground and surface water due in part to the large number of registered pesticides available (EEA, 2005k). At present no EU-wide perspective is possible and data are derived from five national case studies (Austria, Belgium, Denmark, Germany and the UK - England and Wales). These data suggest that the concentration of atrazine in groundwater has declined in four of the five studies (Austria, Belgium, Germany and the UK - England and Wales) during the ten years to 2002 (but not in Denmark). In Austria at least this decline is likely to have been driven by the ban on the use of atrazine (EEA, 2005k).

Consumption of Mineral Fertilisers

Mineral fertiliser consumption data from FAO indicate a trend in most EU-15 Member States from 1990 - 2001 of reduced use of mineral nitrogen fertilisers. Only Spain saw an increase in both N and P consumption, while Ireland increased its N consumption but reduced its P consumption over the same period, as illustrated in Annex Figure 7.



Annex Figure 7 **Evolution in total N and P_2O_5 mineral fertiliser consumption in the EU-15 Member States, 1990–2001**

Source: FAOSTAT data, 2004 (EEA, 2005m)

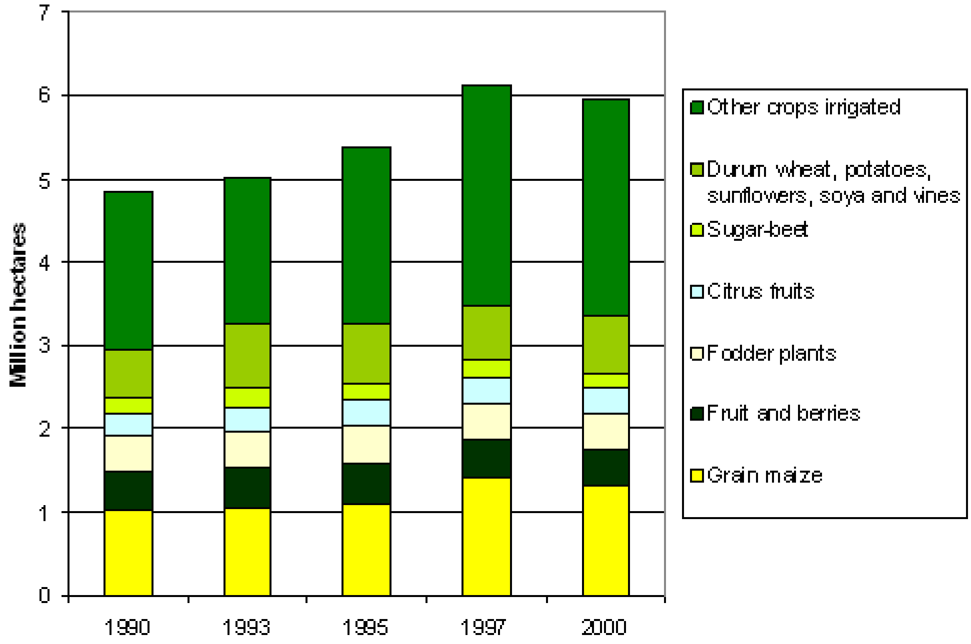
Water Availability

Indicators relating to water availability focus on both the area of land that is irrigated and estimates of the volume of water abstracted (Annex Table 12).

Annex Table 12 Indicators relating to water availability

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Water use (intensity)	IRENA 10, CMEF Baseline indicator 15, OECD agri-environmental indicator iii	↑	-	The irrigable area in EU-12 increased by 12% between 1990 and 2000. In France, Greece and Spain, the irrigable area increased by 29% from 1990–2000 (EEA 2005l).
Water abstraction (second level SDS indicator)	SDI, IRENA 22, OECD agri-environmental indicator iii	↓	+	From 1990-2000 water abstraction in the northern EU-15 MS (AT, BE, DK, DE, FI, IE, LU, NL, SE, UK) decreased by approximately 56%, and the irrigable area decreased by approximately 5%. In the southern EU-15 MS (ES, FR, GR, IT, PT) water abstraction rates decreased by approximately 4%, but irrigable area increased by 14%. (EEA 2005m).
Share of agriculture in water use	IRENA 34.3	=	=	Share of agriculture in water use remained stable in the period 1991–1997 in both northern and southern EU-15 countries, at approximately 7% and 50%, respectively (EEA 2005n)

The over-abstraction of water from rivers and aquifers for agricultural use can cause aquifer exhaustion, reduced river flows and desiccation of wetland habitats, and risk the salinisation or contamination of groundwater by minerals. Irrigation is also associated with increased erosion of some cultivated soils. Data for IRENA indicator 10 (amount of irrigable area) tend to be more complete than those on water abstraction and indicate significant increases over the period 1990-2000 particularly in the southern states of Europe (Annex Table 12). Annex Figure 8 shows that the area of main crops irrigated at least once a year in France, Greece & Spain increased by 23.1 per cent from 1990-2000. Trends in water abstraction (IRENA 22) are derived from national water allocation rates for irrigation based on annual abstraction rates (based on an OECD/Eurostat questionnaire) and irrigable area (based on Farm Structure Survey data) (EEA 2005m). The trends are reported for northern and southern EU-15 Member States (Annex Table 12).



Annex Figure 8 **Trend in irrigated area under different crops in France, Greece and Spain**

Source: Own graph from EEA data (EEA, 2005l)

Soil Functionality

Indicators relating to the impact of agriculture on soil functionality include measures of the occurrence of soil conservation practices, for example minimum tillage, as well as those that measure the maintenance of soil cover, soil organic carbon and risk of erosion (Annex Table 13).

Annex Table 13 Indicators relating to soil functionality

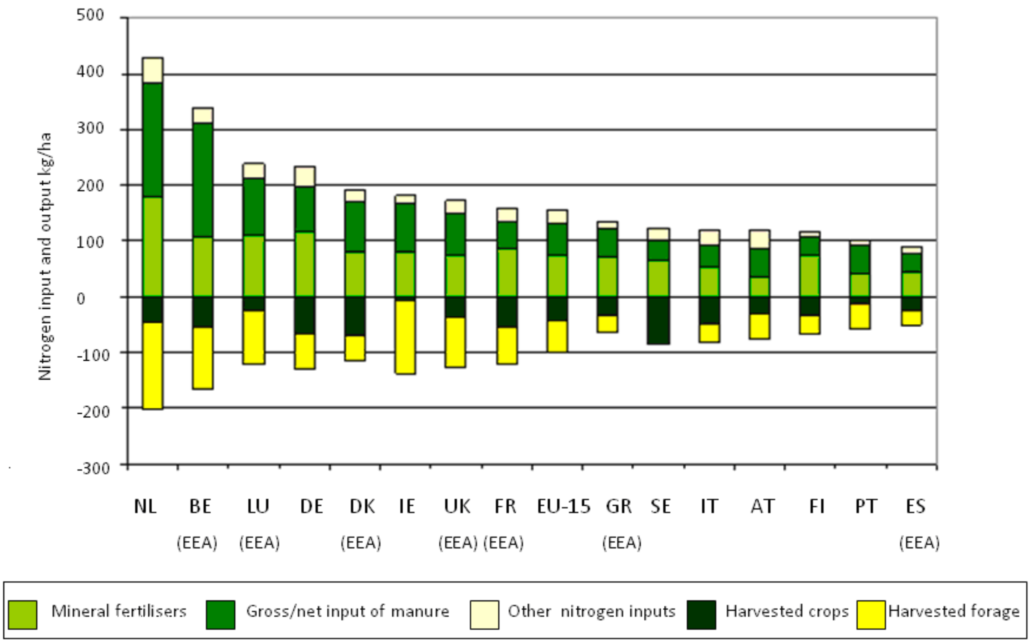
Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Farm management practices - tillage	IRENA 14.1, OECD agri-environmental indicator i	?	?	In most MS (e.g. ES, IT, IE, LU, DK, GR, PT) conservation tillage is carried out on less than 10% of arable land. Conservation tillage methods are increasingly being adopted in all the EU-15 MS (most notably DE, ES, FI, FR, PT and UK). Few data are available however (EEA 2005o).
Farm management practices – soil cover	IRENA 14.2	?	?	In 2000, approximately 56% of the EU-15 arable land was under vegetative cover for 70% of the year and 24% of arable land was covered 80% of the year. Only5 % and 4% of the arable area were covered 50% and 40% of the time throughout the year. Data do not currently offer trend information (EEA 2005o).
Gross nitrogen balance (EEA)/ nitrogen balance of agricultural land	IRENA 18, SEBI 19, CMEF Baseline indicator 20	↓	-	Varies across EU. There is a nitrogen surplus in agricultural soils in EU-15, but no data for EU-12 MS.
Pesticide soil contamination	IRENA 20	↑?	-?	The Indicator is evaluated using a model to calculate the potential annual average content of herbicides in soils. The time series model takes into account the five most used herbicides per region, to detect potential trends under cereal, maize and sugar beet cultivation. The calculations indicate that 10 of the EU-15 Member States face a statistically significant increasing trend for the modelled average quantity of herbicides present in soils under cereal cultivation. Currently the information is

				not sufficient to provide definite conclusions on trends in average annual pesticide content in soils, and even less so on water pollution risks.
Soil erosion (risk by water)	IRENA 23[8], CMEF Baseline indicator 22, OECD agri-environmental indicator i	↓/↑	-/+	Estimated on the basis of the PESERA[8] model, which indicates that the areas with the highest risk of soil erosion by water (i.e. more than 5 tonnes soil loss/ha/year) are located in southern and western Spain, northern Portugal, southern Greece and central Italy. No trend information is currently available (EEA, 2005e).
Soil quality (uses organic carbon content as measure)	IRENA 29	↓/↑	-/+	45% of agricultural area has soils with medium organic carbon content (good condition). Soils with low and very low organic carbon content also account for about 45%. Areas with low organic carbon content (0–1%) appear mostly in southern Europe and correspond to areas with high soil erosion risk. No trend information is currently available (EEA, 2005p).

Sources: [8]PESERA model, (EEA 2005)

Gross nitrogen balance

The gross nitrogen balance of agricultural land represents the potential nitrogen surplus, estimated by calculating the difference between nitrogen added to an agricultural system and nitrogen removed from the system per hectare of agricultural land. The measure gives an indication of soil nutrient levels which affect both the abundance and diversity of soil organisms and plant species present. The measure can also be used for assessing water quality by indicating areas where ground and surface water may be at risk from nitrate leaching. However, IRENA indicators 30.1 and 30.2, which measure the nitrate and pesticide concentrations in soils, provide a more accurate indication of the latter. Annex Figure 9 shows the major inputs and outputs of nitrogen for the EU-15 for 2000. At this level, the greatest input of nitrogen is from mineral fertilisers, followed by organic fertilisers, while the main loss of nitrogen is from harvested forage.



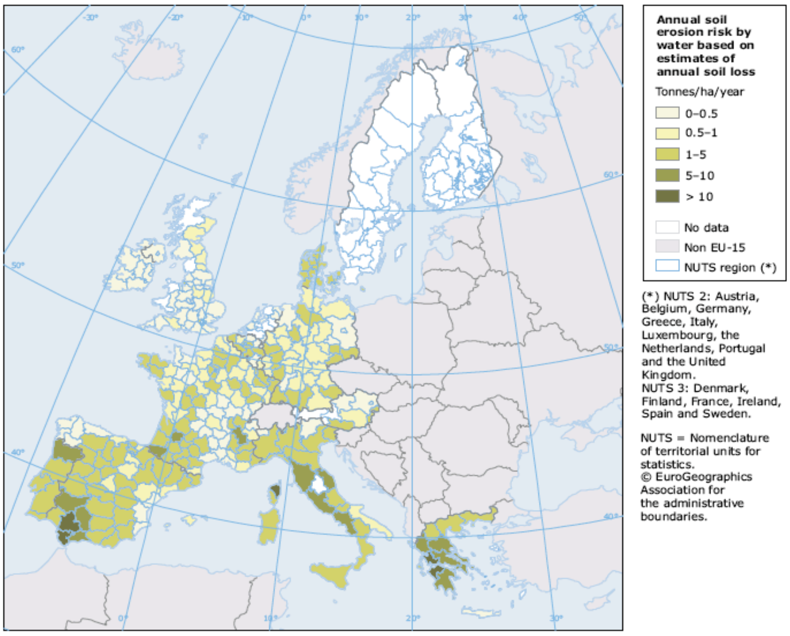
Annex Figure 9 **National nitrogen balances for 2000, divided into major input and output components**

Source: EEA (2005e)

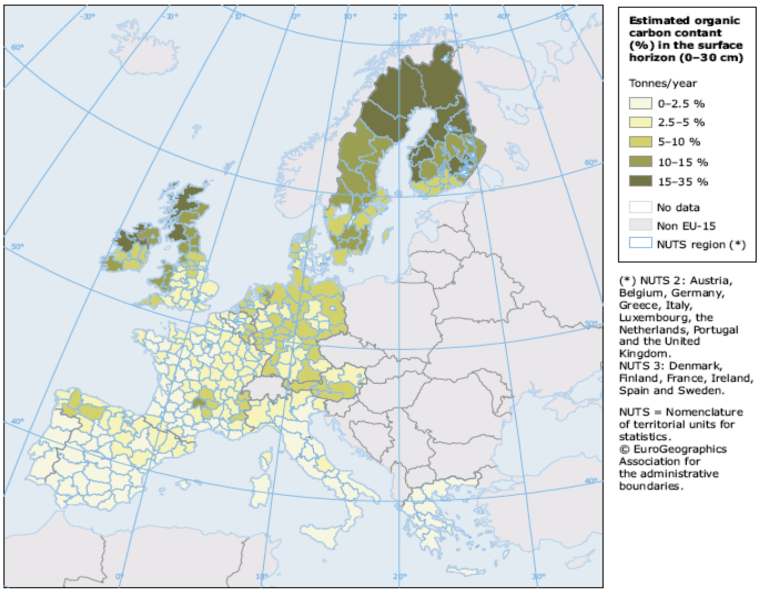
Soil erosion by water

Soil erosion by water is a widespread problem throughout Europe. By removing the fertile topsoil, erosion reduces soil productivity and where soils are shallow, may lead to an irreversible loss of farmland. Severe erosion is commonly associated with the development of temporary or permanently eroded channels or gullies that can fragment farmland. IRENA indicator 23 uses data from the Pan-European Soil Erosion Risk Assessment (PESERA) to quantify soil erosion and assess its risk across Europe (see Annex Figure 10). The resulting map estimates the risk of soil erosion by soil losses in tonnes/ha/year (EEA, 2005e). No overall conclusion can be drawn from this indicator on the actual impact of agricultural practices on current erosion rates in Europe, because of the lack of land use data reporting agricultural management practices, but it does show significant regional differences in risk. Any soil loss of more than 1tonne/ha/year can be considered as irreversible within a time span of 50-100 years, because the rate of soil formation is very slow.

Three zones of soil erosion risk can be distinguished in Europe: a southern zone of severe water erosion risk; a northern loess zone with moderate risk; and an eastern zone where the two zones overlap and where former intensive agricultural practices have resulted in significant erosion problems. The Mediterranean region is particularly prone to erosion because it experiences long dry periods followed by heavy bursts of rain, falling on steep slopes with fragile soils. This contrasts with northwest Europe where soil erosion is less because rain, falling on mainly gentle slopes, is evenly distributed throughout the year. The largest area with a high erosion risk is southern and western Spain (covering 44 per cent of the country's territory), with local erosion hotspots on the southern coast. In Portugal, one third of the country is at a high risk of erosion. In France, Italy and Greece the areas with a high erosion risk cover from 1 to 20 per cent of the land surface respectively.



Annual soil erosion risk by water based on estimates of annual soil loss
Source: PESARA project (Gobin and Govers, 2003).



Estimated organic carbon content (per cent) in the surface horizon (0-30 cm) of soils in Europe
Source: Joint Research Centre, 2004 in EEA (2005p).

Annex Figure 10 Soil erosion risk and soil organic carbon content

Soil organic carbon content

High organic carbon content is associated with high levels of soil functionality, reducing the risk of soil erosion, providing high buffering and filtration capacity, a rich habitat for soil organisms and an enhanced sink for atmospheric carbon dioxide. The EEA considers soil with an organic carbon content of between 1 and 10 per cent to be of high agricultural value, and soils with less than 1 per cent as severely degraded. Annex Figure 10 shows the distribution of topsoil classes in Europe. The disparity between northern and southern Europe is clear and reflects, in part, a clear trend towards low humidity and high temperature in southern Europe where the organic carbon content of topsoil lies between 0 – 1 per cent and corresponds to areas with high soil erosion rates. The organic soils (peat) in northern Europe are also clearly highlighted.

Climate Stability – Carbon Storage

The only indicator relating to carbon storage currently provides information on the organic carbon content of soil (see Annex Table 14).

Annex Table 14 Indicator relating to carbon storage

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Soil organic carbon	CLIMSOIL[9], JRC[10]	?	?	No data, EU estimates based on modelling suggest more stored under grassland than crops

[9]Schils *et al.* (2008) CLIMSOIL.
[10]http://eusoils.jrc.ec.europa.eu/ESDB_Archive/octop/octop_download.html

The trends in soil organic carbon that have been estimated for the main land cover types in Europe - grassland, cropland and forest - are based on modelling results (Annex Table 14)[24]. For European grassland soils, the estimated rate of carbon accumulation ranges from low estimates of between 1 and 45 Tg per year (Smith *et al*., 2005) to estimates as high as 101 Tg per year (Janssens *et al.,* 2003). However the latter are associated with a very large standard deviation (±133 Tg per year), suggesting significant variation in the data. For European croplands, the broad picture is of a carbon pool that is decreasing, with estimates ranging from a small accumulation of 10 Tg per year to a small carbon

[24] The majority of information on soil organic carbon in this section comes from the CLIMSOIL project final report reviewed existing information on the relationship between soil and climate change (Schils *et al*., 2008).

loss of 39 Tg per year (Smith *et al.,* 2005) or to a large carbon loss of 300 Tg per year (Janssens *et al.,* 2003). The latter estimate is again associated with a large standard deviation.

Climate Stability – reduced greenhouse gas (GHG) emissions

Indicators relating to reduced greenhouse gases focus on emissions of methane and nitrous oxide (from agriculture) and the contribution of agriculture to greenhouse gas emissions (Annex Table 15).

Annex Table 15 Indicators relating to greenhouse gas emissions

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Emissions of methane (CH_4) and nitrous oxide (N_2O) from agriculture	IRENA 19	↓	+	From 1990-2002, methane and nitrous oxide emissions decreased by 8.7%. This was due mainly to a 9.4% reduction in methane from reduced livestock numbers and an 8.2% reduction in nitrous oxide from decreased nitrogenous fertiliser use and changed farm management practices (EEA 2006q).
Share of agriculture in GHG emissions	IRENA 34.1, CMEF baseline indicator 26, OECD agri-environmental indicator v	=	=	IRENA 34.1 indicates that agriculture contributed 10% of total greenhouse gas emissions in the EU-15 in 2002 showing a small decrease since 1990 (less than 1%).

In 2002, GHG emissions from agriculture accounted for 10 per cent of the total EU-15 emissions. Agriculture is a major source of methane and nitrous oxide, both powerful greenhouse gases. Emissions of both gases decreased from 1990-2002 but the overall figure masks significant differences between Member States. Based on reported data, Luxembourg (-34 per cent), Finland (-21 per cent), Denmark (-21 per cent) and Germany (-20 per cent) are all performing significantly better than the EU average, whilst Greece (+22 per cent), Spain (+14 per cent) and Ireland (+4 per cent) have all seen marked increases in GHG emissions from agriculture over the same period. In the case of Spain and Ireland, this is largely due to increases in ruminant livestock numbers.

Air Quality

The principal EU indicator that measures the impact of agriculture on air quality is ammonia emissions to air, in addition to the measures of nitrous oxide and methane emissions highlighted in relation to GHG emissions above (Annex Table 16).

Annex Table 16 Indicators relating to air quality

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Emission trends for a number of air pollutants	EEA	↓	+	The NH_3 projections for the EU-27 are 7% under the aggregated emission ceiling. 19 Member States have already reduced ammonia emissions under their ceilings, and the remaining Member States (except Germany and Spain) anticipate reducing emissions in order to reach their respective ceilings by 2010.
Ammonia emissions	IRENA 18sub	↓	+	Within the EU-15, emissions of ammonia to the atmosphere from agriculture decreased by 9% between 1990 and 2002. The majority of this reduction is most likely to be due to a reduction in livestock numbers across Europe (especially cattle), and the lower use of nitrogenous fertilisers.

Ammonia emissions arise primarily as a result of volatilisation from livestock excretions, either from livestock housing, manure and slurry storage, excretions in grazed pastures or after manure spreading onto land (EEA, 2005q). A smaller fraction also results from the volatilisation of ammonia from nitrogenous fertilisers and from fertilised crops. Ammonia, together with emissions of sulphur dioxide and nitrogen oxides, contributes to acidic deposition on soils and aquatic ecosystems, with impacts on plant and freshwater diversity, buildings (& heritage) and human health (EEA, 2005q). Ammonia emissions have declined across the EU-15 over the period 1990-2002 both in percentage terms (Annex Table 16) and in kilograms per utilised agricultural area (EEA, 2005q).

Resilience to Flooding

There is only one indicator that currently exists that might serve as a proxy for this public good, namely the occurrence of flood event in Europe, an indicator that has been designed to measure the relationship between climate change and flooding.

Annex Table 17 Indicator relating to resilience to flooding

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Occurrence of flood events in Europe (indicator CLIM 17)	EEA[11], JRC[12]	↑	-	Indicator designed to assess the relationship between climate change and flooding. Frequency of flooding expected to increase.

[11]http://themes.eea.europa.eu/IMS/ISpecs/ISpecification20080711160148/IAssessment1216632419101/view_content
[12]http://floods.jrc.ec.europa.eu/flood-risk

Vegetation cover, soil infiltration capacity, and drainage systems on agricultural land all influence the rate of transfer of precipitation to main watercourses. Agricultural land can also provide upstream storage areas for floodwater to reduce the risk of urban flooding. There are no EU level data on the contribution of farmland to flood risk.

Resilience to Fire

There are two indicators that can be used as proxies for measuring an increase in the resilience of land to fire, including the area of forest land burnt and forest fire potential (see Annex Table 18).

Annex Table 18 Indicators relating to resilience to fire

Indicator	Source	Status	Implication for the supply of the Public Good	Comments
Forest area burnt	JRC	↓?	+?	Decrease in area burnt, but no information on link with agriculture.
Forest fire danger (indicator CLIM 35)	EEA	↑	-	Significant increase in forest fire potential based on projections of data from 1958 to 2006.

In the Mediterranean region, grazing by farm livestock plays an important role in reducing the risk of fire in forests and permanent crops by preventing build up of dry or woody vegetation. Time series data on forest fires are available for Portugal, Spain, France, Italy and Greece. In these five Member States, a total of 14 million hectares of forest burnt between 1980 and 2008. Over the last eight years, the previous tendency towards an increase in the number of fires in the five southern Member States seems to have stabilised or is even starting to decrease. This may possibly be due to the positive effect of the public information campaigns carried out in all the countries and improvements in the prevention and fire-fighting capacities (JRC, 2009b).

Alongside the information available on the current state of provision of environmental public goods at the EU level, as shown above, a whole range of data exist at the national level. This data vary in their coverage, both spatially and in relation to the range of environmental public goods. Annex Table 19 sets out a range of data sources that exist at the national level, by public good. This list is not exhaustive but provides an illustration of the sort of data that are available.

Annex Table 19 **Data Sources at the National Level Providing Information on Environmental Public Goods**

Agricultural Landscapes
Austria - pasture area
Belgium - woodland area; pasture area
Czech Republic - pasture area
Denmark - woodland area; pasture area
Finland - pasture area
France - pasture area; Land Use Survey (TERUTI) and Farm Structure Survey (FSS)
Germany - pasture area; register of small regional landscape features; farm structure
http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/EN/Navigation/Statistics/LandForstwirtschaft/LandForstwirtschaft.psml
Greece - pasture area
Hungary - pasture area
Ireland - pasture area
Italy – area of woodland; pasture area; landscape conservation data 2000-2005
Luxembourg - pasture area
Netherlands - pasture area; *Steekproef Landschap* (monitoring project on changes in a number of landscape features in the Netherlands 1990, 1996 and 2003)
Poland - pasture area
Portugal - pasture area
Slovakia - pasture area

Spain - pasture area; SISPARES - Monitoring project of forest and land cover change in Spain based on stratified random sample of 215 squares of 4x4 km.

Sweden - pasture area; NILS, the Swedish National Inventory on Landscape, at: http://nils.slu.se/ or http://www.slu.se/?id=965&puff=18. Swedish National Inventory of Forests (RIS) see http://www-ris.slu.se/ nationwide inventory of forests and soils

United Kingdom - pasture area; Countryside Survey - http://www.cs2000.org.uk/report_pdf.htm

Farmland Biodiversity

Austria - fallow area; pasture area; farmland bird populations; SINUS - Stratified random sample of 131 km squares in Austria conducted in 1996 and analysed with the help of aerial photographs and field data. University of Austria

Belgium - woodland area; fallow area; pasture area; farmland bird populations

Bulgaria - grassland survey - Institute of Botany, Wilderness Fund, Bulgarian Society for the Protection of Birds, 2001-2004

Czech Republic - fallow area; pasture area; farmland bird populations

Denmark - pasture area; farmland bird populations

Estonia - grassland Survey - Estonian Fund for Nature and Estonian Semi-natural Community Conservation Association 1998

Finland - pasture area; fallow area; farmland bird populations; agricultural land area under non-chemical pest control management practices

France - pasture area; farmland bird populations; agricultural land area under biodiversity management plans

Germany - pasture area; farmland bird populations; biodiversity and habitats (Federal Statistical Office); German Common Birds Census; national inventory of animal breeding organisations

Greece - pasture area

Hungary - pasture area; Grassland Survey Ministry of Environment, National Authority for Nature Conservation, Institute of Botany 1997-200; farmland bird populations; arable and permanent crop area under integrated pest management

Ireland - pasture area; agricultural land area under biodiversity management plans

Italy - area of woodland; pasture area; farmland bird populations; trends in number of species 1997, 2005; habitats in SIC areas 2007; hunting activities data 2000-2005- Ministry of Environment, WWF, APAT; arable and permanent crop area under integrated pest management

Latvia - grassland survey - Latvian Fund for Nature 1999-2003

Lithuania - grassland Survey - Lithuanian Fund for Nature and Institute of Botany 2002-2005

Luxembourg - pasture area

Netherlands - pasture area; farmland bird populations; agricultural land area under non-chemical pest control management practices; agricultural land area under biodiversity management plans; arable and permanent crop area under integrated pest management

Poland - pasture area; farmland bird populations

Portugal - pasture area; arable and permanent crop area under integrated pest management

Romania - grassland survey - University of Bucharest, Association of Botanical Gardens, Danube Delta Institute 2000-2004

Slovakia - pasture area; grassland survey - Daphne, Institute of applied ecology,1998-2002

Slovenia - grassland survey - Slovenian Natural History Society, Institute of Botany, University of Maribor and of Ljubljana, 1998-2003

Spain - pasture area; farmland bird populations; arable and permanent crop area under integrated pest management; SISPARES - Monitoring project of forest and land cover change in Spain based on stratified random sample of 215 squares of 4x4 km

Sweden - pasture area; farmland bird populations; complete, national survey on all Swedish permanent grassland (meadows and pastures), with 10,000s of data on biodiversity, cultural heritage and other variables. TUVA; agricultural land area under biodiversity management plans

United Kingdom - pasture area; farmland bird populations; Countryside Survey - http://www.cs2000.org.uk/report_pdf.htm ; agricultural land area under non-chemical pest control management practices; agricultural land area under biodiversity management plans

Water Quality

Austria – total pesticide use; agricultural land under integrated pest management

Belgium – total pesticide use; agriculture share of total emissions of nitrogen to surface water; agricultural land under nutrient management planning; agricultural land under non-chemical pest control

Czech Republic - total pesticide use

Denmark - total pesticide use; agricultural land/farms under nutrient management plans

Finland - total pesticide use; agricultural land/farms under nutrient management plans; farms using soil nutrient testing

France - total pesticide use

Germany - total pesticide use; agricultural land/farms under nutrient management plans

Greece - total pesticide use

Hungary - total pesticide use

Ireland - total pesticide use; agricultural land/farms under nutrient management plans

Italy - total pesticide use; Ecological status of water courses (integration of LIM and SCAS indicators) 2000-2006; water Pollution Indicator 2000-2006; Chemical status of water courses 2000-2006

Luxembourg - total pesticide use

Netherlands - total pesticide use; agricultural land/farms under nutrient management plans

Poland - total pesticide use

Portugal - total pesticide use

Romania - data on status of water resources;

Slovakia - total pesticide use; agricultural land/farms under nutrient management plans

Spain - total pesticide use; agricultural land/farms under nutrient management plans

Sweden - total pesticide use; agricultural land/farms under nutrient management plans

United Kingdom - total pesticide use; agricultural land/farms under nutrient management plans

Water Availability
Austria - agricultural ground water withdrawal; irrigation area **Belgium** – agricultural groundwater withdrawals; agricultural surface water withdrawals; irrigation area **Czech Republic** – agricultural groundwater withdrawals; agricultural surface water withdrawal; irrigation area **Denmark** - agricultural groundwater withdrawals; irrigation area **Finland** - agricultural groundwater withdrawals **France** – agricultural groundwater withdrawals; agricultural surface water withdrawals; irrigation area **Germany** - irrigation area **Greece** - agricultural groundwater withdrawals; agricultural surface water withdrawals; irrigation area **Hungary** - irrigation area **Italy** - irrigation area **Netherlands** - agricultural groundwater withdrawals; irrigation area **Poland** – total agricultural water withdrawals; irrigation area **Portugal** - irrigation area **Slovakia** - agricultural groundwater withdrawals; irrigation area **Spain**- agricultural groundwater withdrawals; irrigation area **Sweden** - agricultural groundwater withdrawals; irrigation area **United Kingdom**- agricultural groundwater withdrawals; irrigation area
Soil Functionality
Belgium - agricultural land area under vegetative cover all year; arable land area under soil conservation management practices

Czech Republic - agricultural land area under vegetative cover all year; arable land area under soil conservation management practices **Finland** - agricultural land area under vegetative cover all year **France** - agricultural land area under vegetative cover all year **Germany** - arable land area under soil conservation management practices **Hungary**- arable land area under soil conservation management practices **Italy** - arable land area under soil conservation management practices; Water erosion (ton/ha/year) 1999 - 2004 (national data), 2006-2007 (regional data); percentage organic carbon in soils 1988-2003 - Regional data sources **Portugal** - agricultural land area under vegetative cover all year **Romania** - soil-based data held by the National Research and Development Institute for Soil Science, Agrochemistry and Environment (ICPA) in Bucharest, including various "thematic" maps on soil types, drainage, vulnerability to degradation (salinisation and erosion) etc. **Slovakia** - agricultural land area under vegetative cover all year; arable land area under soil conservation management practices **Sweden -** arable land area under soil conservation management practices
Climate Stability – Carbon Storage
No comprehensive national datasets identified for agricultural land. Linked to sol carbon and vegetation cover, age and structure.
Climate Stability - Greenhouse Gas Emissions
Austria - direct on-farm energy consumption; agricultural GHG emissions **Belgium** - direct on-farm energy consumption; agricultural GHG emissions **Czech Republic** - direct on-farm energy consumption; agricultural GHG emissions Denmark - direct on-farm energy consumption **Denmark** - agricultural GHG emissions **Finland** - direct on-farm energy consumption; agricultural GHG emissions

France - direct on-farm energy consumption; agricultural GHG emissions **Germany** - direct on-farm energy consumption; agricultural GHG emissions; renewable energy Statistische Bundesamt (Federal Statistical Office) http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Publikationen/Fachveroeffentlichungen/UmweltoekonomischeGesamtrechnungen/Indikatorenbericht2006,property=file.pdf **Greece** - direct on-farm energy consumption; agricultural GHG emissions **Hungary** - direct on-farm energy consumption; agricultural GHG emissions **Ireland** - direct on-farm energy consumption; agricultural GHG emissions **Italy**- direct on-farm energy consumption; agricultural GHG emissions **Luxembourg** - direct on-farm energy consumption; agricultural GHG emissions **Netherlands** - direct on-farm energy consumption; agricultural GHG emissions **Poland** - direct on-farm energy consumption; agricultural GHG emissions **Portugal** - direct on-farm energy consumption; agricultural GHG emissions **Slovakia** - direct on-farm energy consumption; agricultural GHG emissions **Spain** - direct on-farm energy consumption; agricultural GHG emissions **Sweden** - direct on-farm energy consumption; agricultural GHG emissions **United Kingdom** - direct on-farm energy consumption; agricultural GHG emissions
Air Quality
See climate stability – GHG emissions
Resilience to Flooding
No national datasets identified. Linked to water use, drainage of land, and land use.

Resilience to Fire
No national datasets identified for agricultural land. Linked to fire risk in forests, especially where adjacent to agricultural land.

Sources: Cooper *et al.,* 2007; Farmer *et al.,* 2008; Jongman and Bunce, 2008; OECD, 2008; OECD Factbook, 2009

ANNEX IV COMPARING PUBLIC DEMAND WITH CURRENT PROVISION OF ENVIRONMENTAL PUBLIC GOODS

Annex IV illustrates the scale of public demand and the current level of provision of selected public goods (agricultural landscapes, farmland biodiversity, water quality, soil functionality and climate stability) either in selected Member States or at the EU scale, amalgamating a range of difference sources of evidence.

Annex Table 20 Evidence for the scale of demand for and supply of landscape in England

Note: EU level targets have been included because they set the frame for political targets in England. Where data could not be disaggregated to the national scale, information pertaining to the UK has also been included.

DEMAND FOR LANDSCAPE IN ENGLAND

EU Level Targets

International Conventions

- None

EU Legislation

- To set up a system of Environmental Impact Assessment for proposals likely to lead to the intensification of semi-natural and uncultivated land (Environmental Impact Assessment Directive 97/11/EC).

EU Strategies, Action Plans etc.

- To encourage the integration of landscape into all relevant policies – cultural, social and economic (Council of Europe, European Landscape Convention, Florence 2000).
- To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … traditional agricultural landscapes (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC).
- To maintain and enhance good ecological infrastructures, and promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final).
- To conserve and appropriately restore areas of significant landscape values including cultivated as well as sensitive areas (Sixth Environmental Action Programme - 1600/2002/EC).

England Level Targets

Public Service Agreement (PSA) target 28

- Secure a healthy natural environment for today and the future. With a specific vision for the conservation of sustainable, living landscapes with best features conserved.

Departmental Strategic Objective (DSO) 2

- A healthy, resilient, productive and diverse natural environment. With targets specific to agriculture as outlined in Intermediate Outcome 2.8: Sustainable, living landscapes with best features conserved.

- Indicator 2.8.1 as defined by the length of linear features managed under agri-environment schemes is used

Agri-Environment Schemes

- Environmentally Sensitive Areas (ESA) and Countryside Stewardship (now closed to new entrants)
- Entry Level Stewardship (ELS)
    - Maintenance and enhancement of landscape quality and character, by helping to maintain important features, such as traditional field boundaries
    - Protection of the historic environment, including archaeological features and traditional farm buildings
- Higher Level Stewardship (HLS)
    - Maintenance and enhancement of landscape quality and character
    - Protection of the historic environment

England Legislation

- Countryside Right of Way Act (CRoW) (2000)
    - Under this act the public have open access to mapped areas of mountain, moor, heath, downland and registered common land.

National Parks and Areas of Outstanding Natural Beauty (AONBs)

- National Parks are designated to preserve and enhance their natural beauty and provide recreational opportunities for the public.
- AONBs are protected areas of high scenic quality specially designated by Natural England to conserve and enhance the natural beauty of their landscapes.

Membership Figures of Organisations

Organisation	Number of Members in UK	% of UK Population	Comments
National Trust (England, Wales and Northern Ireland)	3,560,000	5.60%	12 Corporate Partners 200 Affiliated Centres and Associations
The **Ramblers**	135,000	0.2%	-

Volunteer Figures of Environmental Organisations

BTCV (British Trust for Conservation Volunteers)	30,000 volunteers a year	0.05%	Operates practical conservation holidays in over 20 countries, with 210 UK Conservation Holidays in 2004

Visitor Numbers to National Parks and Other Protected Areas

National Park	Visitors a Year (million)	Visitor Days a Year (million)	Visitor Spend a Year (million)
Broads	5.8	7.2	£296
Dartmoor	2.5	3.3	£123
Exmoor	1.4	2	£83
Lake District	8.3	15.2	£659
New Forest	N/A	13.5	£123
Northumberland	1.7	2.415	£104
North York Moors	6.3	9	£317
Peak District	10.1	N/A	£97
South Downs	N/A	39	N/A
Yorkshire Dales	9.5	12.6	£400
TOTAL	**45.6**	**104.215**	£2202
Source: http://www.nationalparks.gov.uk/press/factsandfigures.htm			
Others			
Areas of Outstanding Natural Beauty (AONB)	3 million visits for all AONBs in England in 2002 (more recent data not available)		
Source : http://www.defra.gov.uk/corporate/about/how/deprep/docs/2009-deptreport.pdf			

Contingent Valuation Studies

Contingent valuation studies provide revealed and stated preferences as well as a willingness to pay (WTP) for certain landscapes or landscape features in the UK.

For example, a study conducted in the Southern Uplands of Scotland revealed that respondents harboured a preference for landscapes with more extensive grazing and more tree cover than present (Bullock and Kay, 1997).

Clark *et al* (2002) used a CV-Bidding Game to establish WTP for the Wildlife Enhancement Scheme for managing the Pevensey Levels landscape via traditional farm practices. WTP varied between residents, visitors and non residents from £133.12, £121.28 to £50.68/household/year respectively. Similarly Garrod and Willis (1995) established a WTP of £25-£172 /household /year for Environmentally Sensitive Area (ESA) schemes supporting benefits to South Downs and a WTP of £17-£22 for landscape benefits to the Somerset Levels and Moors arising from ESA support (Willis *et al.,* 1995).

White and Lovett (1999) established a WTP of £138.28 /individual /year for managing the landscapes within 11 National Parks in England. Whilst Santos (1997) established a WTP of ≈£67-£86 for specific features such as stone walls, barns, hay meadows and small woodlands within upland National Parks.

SUPPLY OF LANDSCAPE IN ENGLAND

Current Levels of Provision

Public Service Agreement (PSA) 28

- Landscape indicators in various types of landscapes are measured (weightings given to each indicator to the contribution of agricultural land management given in brackets):
  - In high value landscapes by condition of SSSIs (32%)
  - In Priority habitats by BAP habitat condition (15%)
  - In other landscapes by extent and quality (2%)
  - In farm woodland by extent and quality (6%)
- Together the landscape features were valued at £417.8m (in 2007)

Departmental Strategic Objective 28, Intermediate Outcome 2

- Approximately 30,000 km of hedgerows have been restored or planted under agri-environment schemes, with a further 125,000 km under ELS
- 2,500 km of dry stone walls have also been restored via these schemes
- As of 2007 the total length of hedgerows in England totalled around 547,000 km with 82,000km of dry stone walls

Uptake of Agri-Environment Schemes (as of 2008)

- Environmentally Sensitive Area Scheme
  - 7,800 agreement holders
  - 503,000 ha of land managed under the scheme
- Countryside Stewardship
  - 12,000 agreement holders
  - 442,000 ha of land managed under the scheme
- Environmental Stewardship (Entry Level Scheme)
  - 37,300 agreement holders
  - 5 million ha of land managed under the scheme
- Environmental Stewardship (Higher Level Scheme)
  - 2,900 agreement holders (almost all of these also have ELS agreements)
  - 291,000 ha of land managed under the scheme
  - 286 standalone HLS agreements covering 51,000 ha of land

Countryside Right of Way Act (CRoW) (2000)

Under the Act people across England have open access to approximately 865,000 ha of land.

Source: https://statistics.defra.gov.uk/esg/ace/pdf/a3.pdf

Annex Table 21 Evidence for the scale of demand for and supply of farmland biodiversity in England

Note: EU level targets have been included because they set the frame for political targets in England. Where data could not be disaggregated to the national scale, information pertaining to the UK has also been included.

DEMAND FOR BIODIVERSITY IN ENGLAND

EU Level Targets

International agreements

- To achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level by 2010 (Convention on Biological Diversity, 1992).
- To protect and promote the wise use of wetlands (Ramsar Convention, 1971).

EU Legislation

- To maintain populations of a specified list of rare or threatened birds and migratory birds at certain levels through measures including the creation of protected areas; to maintain the appropriate management of habitats within protected areas; to re-establish destroyed habitats and to create habitats (Birds Directive - 79/409/EEC).
- To protect all wild birds, including in general a prohibition on their killing and the destruction of their nests (Birds Directive - 79/409/EEC).
- To set up of a network of Special Areas of Conservation sufficient to ensure the favourable conservation status of a specified set of habitats and species throughout their natural range and to put in place of all necessary measures to ensure the protection and management of these sites to achieve these objectives (Habitats Directive - 92/43/EEC).
- To prohibit the killing, disturbance and destruction of nests of certain animal species and of the picking of certain plants (Habitats Directive - 92/43/EEC).

EU Strategies, Action Plans etc.

- To halt the loss of biodiversity and contribute to a significant reduction in the worldwide rate of biodiversity loss by 2010 (EU Sustainable Development Strategy, Council Decision 10117/2006).
- To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … biodiversity and the preservation and development of high nature value farming and forestry systems (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC).
- To promote and support environmentally-friendly farming practices and systems that benefit biodiversity directly or indirectly (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final).
- To support sustainable farming activities in biodiversity-rich areas (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final).
- To maintain and enhance good ecological infrastructures, and promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final).
- To conserve species and habitats, with special concern to prevent habitat fragmentation

(Sixth European Environmental Action Plan 1600/2002/EC)

- To protect/restore nature and biodiversity from damaging pollution (Sixth European Environmental Action Plan 1600/2002/EC).

National Targets (England)

Biodiversity Action Plan: Long Term Vision for the Agriculture Work Programme 2006-2010
Conservation and enhancement of biodiversity associated with farmed and semi-natural habitats, within the context of viable rural business in which land managers maximise, and are valued for, their contribution to conservation.

UK BAP Targets for England

A1(a) **To reverse the decline in farmland bird populations by 2020**, with additional individual Biodiversity Action Plan (BAP) targets for seven priority bird species within this indicator.

A1(b) **To reverse long term declines in farmland butterfly populations**, with individual BAP for nine priority butterfly species which occur on semi- natural farmland habitats across the UK.

A2 **To increase the proportion of farmland SSSIs in favourable condition,** by bringing 95 per cent by area of nationally important wildlife sites (SSSIs) which include farmland SSSIs into favourable or unfavourable but recovering condition by 2010.

A3 **To reduce the proportion of priority habitats and species for which status is unknown, and to halt and ultimately to reverse the decline in farmland priority species and habitats,** where each priority habitat and species has specific, time limited targets intended to safeguard and enhance extent and population.

A4 **To conserve and restore productive land by reversing the decline of plant diversity and field margins.**

A5 **To halt the losses of farmland features of value for wildlife and promote their positive management.**

Source: Defra (2006)

Overview of Quantitative UK BAP Targets for England for Agriculture for 2015

Habitat	Maintenance	Achieve Condition by 2015	Condition (%)*	Restoration by 2015	Restoration (%)*	Expansion by 2015	Expansion (%)*
Arable margins	N/A	Tbc	-	-	-	69,378 ha	-
Blanket bog	240,000 ha	Tbc	-	-	-	-	-
Hedgerows	558,150 km	279,075 ha	50	-	-	6,400 km	1
Limestone pavement	2,340 ha	Tbc	-	4 sites	-	-	-
Lowland calcareous grassland	38,687 ha	32,036 ha	83	726 ha	2	8,426 ha	22
Lowland dry acid grassland	20,142 ha	17,295 ha	86	285 ha	1.4	276 ha	1.4
Lowland heathland	58,000 ha	47,000 ha	81	-	-	7,600 ha	13

Lowland meadows	7,282 ha	6,078 ha	83.5	481 ha	7	256 ha	3.5
Purple moor-grass and rush pastures	21,544 ha	19,195 ha	89	128 ha	1	151 ha	1
Upland calcareous grassland	16, 000 ha	Tbc	-	-	-	-	-
Upland hay meadows	870 ha	830 ha	95.4	48	5.5	72	8
Upland heathland	220,000 ha	Tbc	-	-	-	-	-

Source: Defra (2006)

Membership Figures of Environmental Organisations

Organisation	Number of Members in UK	% of UK Population	Comments
RSPB	1,049,392	1.71%	-
UK Wildlife Trusts (Comprised of 47 Local Wildlife Trusts)	791,000	0.13%	110 Corporate Members Support Active Citizenship in 5,000 community based groups

Visitor Numbers to Protected Areas and National Nature Reserves

Natural England National Nature Reserves	Visitor numbers were just under 18 million in the 2006/07 period
RSPB Reserves	Annual visits exceeded 1.8 million in 2008
Wildlife Trust Reserves	Visitor numbers were just over 4 million for the 2006/07 period

Source: http://www.defra.gov.uk/wildlife-countryside/pdf/biodiversity/indicator/200810p1.pdf

Contingent Valuation Studies

Hanley *et al.,* (1998) assessed the economic value of the conservation benefits of the Breadalbane Environmentally Sensitive Area (ESA) in Scotland, using both Contingent Valuation (CV) and Choice Experiment (CE) methods. Respondents expressed positive WTP for all the attributes at the "policy on" levels, and had positive WTP for greater levels of broad-leaved woodland, heather moors and wet grassland.

Hanley *et al.,* (2007) investigated the respondents' willingness-to-pay (WTP) for landscape features and habitats. A Choice Experiment was used to estimate WTP for different landscape features in four Severely Disadvantaged Areas of England (SDAE). The study finds that environmental benefits vary both by landscape feature "produced" and by region. WTP is highest for heather moorland conservation, broadleaved and mixed woodlands and cultural heritage features such as old stone barns. The study did not find a significant WTP for field boundaries. Values for given landscape features vary regionally.

Christie et al (2004) conducted a CV study by applying CE exercises to a random sample of 741 people living in Cambridgeshire and Northumberland, two areas which are said to represent the range of biodiversity within the UK. Respondents were asked which aspects of biodiversity they would prefer to be protected and enhanced. Each respondent undertook five choice tasks. The payment vehicle was annual increase in general taxation, ranging from £0 to £520 for the next five years.

The implicit prices of biodiversity attributes shows on average the “marginal” WTP per year in higher taxes to move from status quo to a higher level. Enhancements in almost all the biodiversity attributes from the status quo were positively valued in both areas. The exception was a move to slow down the rate of decline of rare, unfamiliar species in Cambridgeshire. The highest WTP was associated with a move from continued decline to stopping decline and ensuring recovery of rare unfamiliar species in Northumberland, with an implicit price of £115 per person in Cambridgeshire and £189.05 per person in Northumberland.

In this study, a total of 673 CE respondents were asked to make trade-offs between combinations of environmental, landscape and access, and rural development policy aims. The CE format presented pairs of policy scenarios, each containing a combination of policy options including an associated cost to the taxpayer payable via general taxation. Analysis of the observed choices revealed the relative weight of public preferences assigned to the different policy options and, from the trade-off between cost and policy options, an implicit valuation of the policy option.

Estimates of goods and services	CE implicit prices (compared to status quo)	mean WTP from CV study (decomposing using MCA weights)
Enhanced wildlife habitats:	£50.94 (3)	£ 6.89 (3)
Enhances quality of rivers, lochs (lakes) and wetlands	£55.27 (2)	£ 8.66 (1)
Enhanced landscape appearance	£27.49 (6)	£ 1.73 (7)
Enhanced public access to the countryside	£29.43 (5)	£ 2.88 (5)
Preserve rural communities		£ 2.70 (6)
Maintaining farming communities	£ 50.07 (4)	£ 7.61 (2)
Promoting locally grown food	£ 74.01 (1)	£ 6.49 (4)

Overall mean WTP from CV study was £37.55 per household. The interviews with MCA and CV – WTP were carried out with 169 adults who were representative of the population of Scotland, in face-to-face interviews.

Alvarez - Farizo *et al.,* (1999) report on an open-ended CV study on the conservation benefits of environmentally sensitive areas in Scotland. Land cover includes grasslands, cultivated Machair, dune systems and rough pasture. The area supports rare breeds of birds and flowers. An initial attitude survey of 150 respondents was undertaken and the payment vehicle was national taxes. The target population for the main survey was three-fold: the UK general public, residents in the ESA and visitors to the ESAs. Both mail and in-person interviews were carried out. A total of 358 useable responses were obtained.

Mean WTP (with 95% Confidence Interval for Mean) for Machair ESA was estimated to £13.44 (10.10 – 16.78) (1995 prices) per household per year. The Machair ESA is spread over 15166 hectares of coastal plain on five islands.

Hanley and Oglethorpe (2001) estimate demand for the preservation of landscape elements through a CV-study in four regions in the UK: Cambridgeshire, East Yorkshire, Devon, and Herford.

WTP for the protection of hedgerows from further losses were:

- In two samples Devon, the WTP ranged from €23.16 and €41.60, for 10% and 50% losses, to €24.58 and €30.73 for 10% and 33% losses.
- In Hereford, the comparable figures were €16.86 and €23.95 (10% and 50% losses) and €30.41 and €41.13 (10% and 33% losses).

WTP for the preservation of field margins were:

- In one sample in Cambridgeshire a WTP for a 5 % increase in field margins of €18.17 per household / yr compared with €23.16 for a 25 % increase, was found.

- In a second sample in Cambridgeshire, WTP was higher, but showing the same pattern: €22.38 for a 5% increase and €26.32 for a 10% increase.
- In East Yorkshire, the relevant values in two samples were €20.33 and €21.27 (5% and 25%), and €25.21 and €29 (5% and 10%).

CV and CE were employed by Christie *et al.,* (2006) in order to analyse the WTP for various policy scenarios aimed at increasing biodiversity in two case study UK National Parks. In Cambridgeshire the WTP for agri-environment schemes engaging in habitat creation schemes was €108, whereas the WTP for the protection of farmland currently in agri-environmental usage was €66. In Northumberland the WTP for agri-environment schemes engaging in habitat creation schemes was €69, whereas the WTP for the protection of farmland currently in agri-environmental usage was €54.

SUPPLY OF BIODIVERSITY IN ENGLAND

Current Levels of Provision

UK BAP Farmland Biodiversity indicators for England

A1(a) **To reverse the decline in farmland bird populations by 2020**
This indicator is assessed as **deteriorating** both over the long term and since 2000. After a decade of apparent stabilization, a **further decline** is apparent since 2006. While there are increases in generalist species, these mask declines in other more specialist species.

A1(b) **To reverse long term declines in farmland butterfly populations**
The indicator is assessed as **deteriorating** over both the long and shorter term. There are **significant declines** in both generalist and specialist species.

A2 **To increase the proportion of farmland SSSIs in favourable condition**
This indicator is assessed as **improving** as there is continuing progress being made in meeting the England BAP strategy objectives.

A3 **To reduce the proportion of priority habitats and species for which status is unknown, and to halt** Despite a **recent improving status** 36% of the priority species are still **declining or have been lost**.

A4 **To conserve and restore productive land by reversing the decline of plant diversity and field margins**
This indicator showed a clear **negative trend** for the 2003 baseline assessment, but was not updated in the 2006 assessment.

A5 **To halt the losses of farmland features of value for wildlife and promote their positive management**

This indicator was assessed as having **no clear trend** when it was last published in 2003 and the data have not been updated by the 2006 assessment

Source: Defra (2009a)

Annex Table 22 Evidence for the scale of demand for and supply of water quality and availability in Spain

Note: EU level targets have been included because they set the frame for political targets in Spain.

DEMAND FOR SUPPLY OF WATER QUALITY AND AVAILABILITY IN SPAIN

EU Level Targets for Water Quality

International conventions

- To prevent and control pollution, sustainable use and conservation of transboundary watercourses and lakes (Helsinki Convention 1992).

EU Legislation

- To enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, promote the sustainable use of water and reduce water pollution (Water Framework Directive 2000/60/EC).
- To achieve good ecological status of all water bodies by 2015 (Water Framework Directive 2000/60/EC).
- To reduce the pollution of water caused or induced by the application and storage of inorganic fertiliser and manure on farmland and prevent further such pollution to safeguard drinking water supplies and to prevent wider ecological damage through the eutrophication of freshwater and marine waters. (Nitrates Directive 91/676/EC).
- To prevent the discharge of certain toxic, persistent and bioaccumulable substances into groundwater (Groundwater Directive 80/68/EEC)
- To protect the environment as a whole by preventing or minimising emissions to all media (air, land and water) (IPPC 96/61/EC)
- To reduce risks and impacts of pesticide use on human health and the environment and encourage the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides (Pesticides Framework Directive 2009/128/EC)

EU Strategies, Action Plans etc.

- To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … water…. (Community Strategic Guidelines for Rural Development, 2007 – 2013 2006/144/EC).

EU Level Targets for Water Availability

International conventions

- None

EU Legislation

- To promote the sustainable use of water and to mitigate the effects of droughts (Water Framework Directive 2000/60/EC)

EU Strategies, Action Plans etc.

- To introduce policy options to address and mitigate the challenges posed by water scarcity and drought within the Union (Addressing the challenge of water scarcity and droughts in the European Union COM/2007/0414)

National Targets (Spain)

- Creation of a public water bank in each of the river basin Management Authorities.
- Water pricing according to cost and use.
- Re-utilisation of 3.000 hm^3 of waste water treatment plant water by 2015
- Achievement of a good chemical status of water.
- Water savings due to improvement of infrastructure to reach 1,375 hm^3 per year.
- Water consumption limited to 4,200 m^3 per year for farms in over-exploited aquifers.
- Maximum levels of pesticide residues in water should be below 0.1 µg/l or 0.5 µg/l if referred to total residue

Attitudinal Surveys

How serious a problem do you think water quality is? (%) *note- non answers not included so may not = 100%*

Answer	**EU-27**	**UK**	**FR**	**DE**	**ES**	**IT**	**SE**	**CZ**	**RO**
Very serious	30	10	48	19	29	47	17	15	61
Fairly serious	38	34	40	37	38	36	48	34	27
Not serious (combined)	28	54	10	41	31	14	30	43	10

How serious do you think water quantity related problems are? (%) *note- non answers not included so may not = 100%*

Answer	**EU-27**	**UK**	**FR**	**DE**	**ES**	**IT**	**SE**	**CZ**	**RO**
Fairly serious	27	18	43	13	35	41	8	12	47
Fairly serious	36	39	41	30	39	35	35	32	32
Not serious (combined)	35	42	14	55	34	31	52	50	17

How do you think water quality has changes in the past five years? (%)*note- non answers not included so may not = 100%*

Answer	**EU-27**	**UK**	**FR**	**DE**	**ES**	**IT**	**SE**	**CZ**	**RO**
Deteriorated	37	25	49	20	48	52	44	26	61
Stayed the Same	30	33	22	29	33	26	27	29	25
Improved	27	35	24	46	13	16	24	37	9

Source: Special Eurobarometer Report 313 (published July 2009)
http://ec.europa.eu/public_opinion/flash/fl_261_en.pdf

SUPPLY OF WATER QUALITY AND AVAILABILITY IN SPAIN

Current Levels of Provision

Bathing Water Quality (as of 2008)

- 36.6% of freshwater bathing sites were compliant with guide values (a decrease of 1.4% on the previous year)
- 93.5% of freshwater bathing sites were compliant with mandatory values (an increase of 6.2% from the previous year)
- 1.6% of freshwater bathing sites were non compliant
- 3.2% of all freshwater bathing sites were banned/closed throughout the season
- From 1990 onwards there has been an overall increase in the quality of bathing water in Spain

Nitrates

- Nitrogen surplus in the order of 100-150 kg N/ha a year can be found in Spain (Catalonia). This is in contrast with all other Member States (except Ireland) who are experiencing a decline while between 1990 and 2000 Spain observed a 47% increase in gross nitrogen balance

- Spain was among several other Member States with the highest reported percentage of nitrogen in groundwater as sampling sites exceeding 50 mg NO_3/l (from 60% to 20% of the monitoring stations)
- In the north-east and south of Spain a significant proportion of surface water values were between 10 and 25 NO_3/l, highlighting considerable nitrogen fluxes to lakes and seas and the important potential eutrophication effects
- There are incidents in eastern Spain of sampling stations showing increasing trends of surface waters containing trends of increasing nitrogen concentration which is contrast to the majority of EU surface waters that show decreasing or stable trends
- Between 1999 and 2007 Spain increased its numbers of nitrate vulnerable zones from 5 to 11%

Water Availability

- Among all the Member States Spain shows a high national estimated Water Exploitation Index (WEI) (approximately 34%)
- However, in individual regions of Spain this WEI is often much higher, reaching 164% and 127% in Andalusia and Segura respectively
- The Spanish water administration has identified 51 hydrological units as overexploited. Meaning the ratio of groundwater abstraction to the renewable resource is between 1.0 and 1.2 (Custodio, 2002)

Source: EEA (2009a, 2009d)

Annex Table 23 Evidence for the scale of demand for and supply of soil functionality in the EU

DEMAND FOR SOIL FUNCTIONALITY IN THE EU

EU Level Targets

International conventions

- None

EU Legislation

- None (although draft Soil Framework Directive under discussion COM(2006) 232)
- To regulate the use of sewage sludge in agriculture in such a way as to prevent harmful effects on soil, vegetation, animals and man (Sewage Sludge Directive 86/276/EEC
- To protect the environment as a whole by preventing or minimising emissions to all media (air, land and water) (IPPC 96/61/EC).

EU Strategies, Action Plans etc.

- To protect and ensure the sustainable use of soil by preventing further soil degradation and restoring degraded soils (Thematic Strategy for Soil Protection COM(2006) 231 Final)
- To promote the sustainable use of soil, with particular attention to preventing erosion, deterioration, contamination and desertification (Sixth Environmental Action Programme 1600/2002/EC)

Contingent Valuation Studies

Colombo *et al,.* (2006) found a willingness to accept compensation of €26.5 per inhabitant per year to partake in the off-site mitigation of the impact of soil erosion in a watershed in Andalusia.

Kallas *et al.,* (2006) found a willingness to pay of €2.6 per year for each ton of soil per hectare that was not eroded in the case study Spanish olive orchards.

Krumalova *et al,.* (2000) found a willingness to pay of €18.9 per year in replacement costs for soil erosion in three landscape protected areas in Czechoslovakia.

Colombo *et al,.* (2003) found a willingness to pay of €42-72 per year per hectare to reduce off-site damage costs to soil in a catchment in the Alto Genil area of southern Spain.

Mogas and Riera (2001) found a willingness to pay of €2.7 per inhabitant per year for an extension of soil productivity in Cataluna, Spain

Consultation undertaken for EU Soil Thematic Strategy in 2005, reported in Impact Assessment of the Soil Thematic Strategy (COM (2006) 231 final)

A consultation involving 1,206 EU citizens, 377 soil experts and 287 organisations from 25 countries indicated that 91% of participants considered that preventing and mitigating soil degradation in Europe is important or very important. 74.6% favoured action being taken in the form of a framework adopted at EU level with concrete measures at national or local level (16.4% advocated taking all measures at EU level), 87.8% supported the identification of risk areas and 96.5% supported the obligation to adopt measures in those areas.

SUPPLY OF SOIL FUNCTIONALITY IN THE EU

Current Levels of Provision

EU-wide indicators: Data on the pressures on soil are available, as indicated by cropping / livestock patterns, farm management practices and the balance of intensive and extensive practices, as well as on the state of soils as indicated by soil erosion and soil quality (EEA, 2006 b, c). Data are also collected on soil nutrient load and contamination, the former being also used as an indirect measure of the risk of diffuse pollution to water (EEA, 2005k). Indicators of soil functionality are included in the IRENA programme (EEA), the CMEF (EAFRD) and the OECD agri-environmental indicators of regional importance. These monitoring programmes provide some information on the current supply of soil conservation measures at both national and EU scale.

Pressures on soil: Agricultural intensification has been a predominant trend in the EU-15 for several decades, but for the period 1990-2000 there is evidence that the trend is stabilising. Low-input farms increased from 26-28% between 1990 and 2000, and high-input farms decreased from 44-37% for the same period. However, the area of permanent grassland and permanent crops declined on average, by 4.8% and 3.8% respectively across the EU, with particularly large declines (>25%) in Denmark, central and western France.

Adoption of beneficial farm management practices: Soil cover and appropriate tillage practices are crucial for protecting soils from erosion and the loss of organic matter. In 2000, approximately 56% of arable land in the EU-15 was covered for 70% of the year, and 24% of arable land was covered 80% of the year. 5% and 4% of arable land was covered for just 50% and 40% of the year respectively. The lowest degree of soil cover was found in eastern Austria, Greece, south western France, Finland and southern Sweden (EEA, 2005e). Farm practices such as mulch tillage, minimum and reduced tillage reduce some of the environmental impacts of cropping on arable land. These practices are being adopted increasingly within the EU-15 MS, in particular in DE, ES, FI, FR, PT and UK. 11 of the EU-15 MS specify practices to conserve and protect soils in their national codes of good farming practice (GFP) (EEA, 2005e).

Nutrient load and contamination of agricultural soils: Nutrient load or mineral balances establish links between agricultural nutrient use, changes in environmental quality and the sustainable use of soil nutrients. A persistent surplus indicates potential environmental problems; a persistent deficit indicates a potential risk of decline of soil nutrient status (EEA, 2005p). In 2000, the gross nitrogen balance for the EU-15 level was calculated to be 55 kg/ha, which was 16 % lower than the estimate for 1990. However, there was significant variation across MS, ranging from a gross nitrogen balance estimated at 37 kg/ha (Italy) to 226 kg/ha (the Netherlands). Estimates declined across all MS between 1990 and 2000, apart from Ireland and Spain (22 and 47% increase, respectively). Average organic fertiliser application rates were generally lower than the threshold of 170 kg/ha specified by the nitrates directive in 2000 except in Belgium and the Netherlands, which were 204 and 206 kg/ha respectively.

Soil erosion: Across the EU-15, three zones of erosion can be distinguished: a southern zone characterised by severe water erosion and a northern loess zone with moderate rates of water erosion, and an eastern zone where the two zones overlap and where former intensive agricultural practices have resulted in significant erosion problems. South-western Spain, northern Portugal, southern Greece and central Italy are predicted to have a high erosion risk of > 5 tonnes/ha/year. Predictions are taken from the Pan-European Soil Erosion Risk Assessment (PESERA) model and estimate soil erosion risk by water across Europe (EEA, 2005e).

Soil organic carbon content: This is assessed using measures of soil organic carbon content which also provide a link with climate change mitigation (indicating the capacity of soils to store organic carbon). The distribution of organic carbon content across Europe shows that areas of very low organic carbon content (0 – 1 %) appear mostly in southern Europe and correspond with areas with high soil erosion rates and warmer climates (EEA, 2005p).

Annex Table 24 Evidence for the scale of demand for and supply of climate stability in the EU

DEMAND FOR CLIMATE STABILITY IN THE EU

EU Level Targets for carbon storage

International conventions

- To protect and maintain carbon stores (Kyoto Protocol, 1997).

EU Legislation

- None

EU Strategies, Action Plans etc.

- To protect and ensure the sustainable use of soil (Thematic Strategy for Soil Protection COM(2006) 231 Final).

EU Level Targets for reduction in greenhouse gases

International conventions

- To reduce atmospheric GHG Emissions (carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_20)) by 8% compared to 1990 levels by 2012 (Kyoto Protocol, 1997) – NB: Target does not relate solely to agriculture.

EU legislation

- None

EU Strategies, Action Plans etc.

- To fulfil the commitment of an 8 % reduction in emissions by 2008-12 compared to 1990 levels for the European Community as a whole, in accordance with the commitment of each Member State set out in the Council Conclusions of 16 and 17 June 1998 (Sixth

Environmental Action Programme 1600/2002/EC)

- To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … climate change (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC)

Attitudinal Surveys

How serious a problem do you think global warming / climate change is at this moment? (%)

Answer	**EU-27**	**UK**	**FR**	**DE**	**ES**	**IT**	**SE**	**CZ**	**RO**
Very serious	75	59	84	74	83	74	77	76	73
fairly serious	15	23	12	16	9	14	15	16	12
Serious (combined)	90	82	96	90	92	88	92	92	85

In your opinion, which of the following do you consider to be the most serious problem currently facing the world as a whole? (%) Two answers allowed

Answer	**EU-27**	**UK**	**FR**	**DE**	**ES**	**IT**	**SE**	**CZ**	**RO**
Global warming /climate change*	62	57	71	71	61	47	74	45	60

In your opinion, is the EU currently doing too much, doing about the right amount, or not doing enough to fight climate change (%)

Too much	3	4	2	3	3	2	1	3	2
About right amount	25	25	16	37	19	20	18	36	24
Not enough	58	49	71	53	59	63	73	50	51

In your opinion, is your national government currently doing too much, doing about the right amount, or not doing enough to fight climate change (%)

Answer	**EU-27**	**UK**	**FR**	**DE**	**ES**	**IT**	**SE**	**CZ**	**RO**
Too much	4	7	2	8	3	2	4	2	2
About right amount	24	32	17	40	17	15	33	21	14
Not enough	64	54	76	48	64	72	59	71	66

Source: Special Eurobarometer Report 313 (published July 2009)
http://ec.europa.eu/public_opinion/archives/eb_special_en.htm

SUPPLY OF CLIMATE STABILITY IN THE EU

Current Levels of Provision

The forces driving the contribution of agriculture to climate change are energy use, cropping/livestock patterns and mineral fertiliser consumption (EEA, 2005r). These give rise to methane and nitrous oxide emissions which are the core parameters determining the size of agriculture's contribution to climate change. The IRENA monitoring programme (EEA) includes specific indicators for these emissions and also measures agriculture's share in GHG emissions (EEA, 2005r).

In absolute amounts, the agriculture sector emitted 416 million tonnes CO_2 equivalent of greenhouse gases in 2002; a 8.7% reduction compared to 1990 levels. This was mainly due to a 9.4% reduction in methane following a decline in cattle numbers, and an 8.2% reduction in nitrous oxide emissions from agricultural soils due to a decrease in the use of nitrogenous fertilisers (EEA, 2005r). The figures vary significantly between different Member States: thus levels in Luxembourg and Finland decreased by 34% and 21 % respectively, whilst those in Greece and Spain increased by 22% and 14% respectively.

Currently, agriculture's contribution to total EU greenhouse gas emissions is about 10%, down from 11% in 1990 (EEA, 2005r). Agricultural emissions in the 27 EU countries actually fell by 20% between 1990 and 2006 as a result of the significant decline in livestock numbers, more efficient application of fertilisers and better manure management. This is well above the average 11% reduction in emissions in all EU sectors. These changes have been driven in part by certain policy measures under the CAP and the implementation of the Nitrates Directive 91/676/EC (EEA, 2004i). All EU-15 Member States have action plans for climate change and air quality.

Source: http://ec.europa.eu/agriculture/climate_change/index_en.htm

ANNEX V EU LEVEL TARGETS FOR THE PROVISION OF PUBLIC GOODS

Annex Table 25 sets out the targets – at the EU level – for the ten environmental public goods that form the focus of this study. It contains both explicit targets - often contained within international and EU level agreements and conventions, which set out the EU's formal environmental commitments, and within certain pieces of EU and/or national legislation – as well as implicit targets which are embedded within particular policies such as those found within the Community Strategic Guidelines for Rural Development (Council Decision 2006/144/E). Certain of these targets are enshrined in legislation, whereas others are not legally binding on the Member States.

These targets apply to all Member States[25]. In many cases, they are then translated into targets at the national and/or regional levels, although the degree of detail in which this is done varies between Member States.

Annex Table 25 EU level targets for the provision of public goods

Agricultural Landscapes
International Conventions • None *EU Legislation* • To set up a system of Environmental Impact Assessment for proposals likely to lead to the intensification of semi-natural and uncultivated land (Environmental Impact Assessment Directive 97/11/EC). *EU Strategies, Action Plans etc.* • To encourage the integration of landscape into all relevant policies – cultural, social and economic (Council of Europe, European Landscape Convention, Florence 2000). • To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … traditional agricultural landscapes (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC). • To maintain and enhance good ecological infrastructures, and promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final). • To conserve and appropriately restore areas of significant landscape values including cultivated as well as sensitive areas (Sixth Environmental Action Programme - 1600/2002/EC).
Farmland Biodiversity
International Conventions • To achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level by 2010 (Convention on Biological Diversity, 1992).

[25] With the exception of the European Landscape Convention which has to be ratified by Member States

- To protect and promote the wise use of wetlands (Ramsar Convention, 1971).

EU Legislation

- To maintain populations of a specified list of rare or threatened birds and migratory birds at certain levels through measures including the creation of protected areas; to maintain the appropriate management of habitats within protected areas; to re-establish destroyed habitats and to create habitats (Birds Directive - 79/409/EEC).
- To protect all wild birds, including in general a prohibition on their killing and the destruction of their nests (Birds Directive - 79/409/EEC).
- To prohibit the killing, disturbance and destruction of nests of certain animal species and of the picking of certain plants (Habitats Directive - 92/43/EEC).

EU Strategies, Action Plans etc.

- To halt the loss of biodiversity and contribute to a significant reduction in the worldwide rate of biodiversity loss by 2010 (EU Sustainable Development Strategy, Council Decision 10117/2006).
- To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … biodiversity and the preservation and development of high nature value farming and forestry systems (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC).
- To promote and support environmentally-friendly farming practices and systems that benefit biodiversity directly or indirectly (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final).
- To support sustainable farming activities in biodiversity-rich areas (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final).
- To maintain and enhance good ecological infrastructures, and promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final).
- To conserve species and habitats, with special concern to prevent habitat fragmentation (Sixth European Environmental Action Plan 1600/2002/EC)
- To protect/restore nature and biodiversity from damaging pollution (Sixth European Environmental Action Plan 1600/2002/EC).
-

Water Quality

International Conventions

- To prevent and control pollution, sustainable use and conservation of transboundary watercourses and lakes (Helsinki Convention 1992).

EU Legislation

- To enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, promote the sustainable use of water and reduce water pollution (Water Framework Directive 2000/60/EC).
- To achieve good ecological status of all water bodies by 2015 (Water Framework Directive 2000/60/EC).
- To reduce the pollution of water caused or induced by the application and storage of inorganic fertiliser and manure on farmland and prevent further such pollution to safeguard drinking water supplies and to prevent wider ecological damage through the eutrophication of freshwater and marine waters. (Nitrates Directive 91/676/EC).
- To prevent the discharge of certain toxic, persistent and bioaccumulable substances into groundwater (Groundwater Directive 80/68/EEC)
- To protect the environment as a whole by preventing or minimising emissions to all media (air, land and water) (IPPC 96/61/EC)
- To reduce risks and impacts of pesticide use on human health and the environment and encourage the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides (Pesticides Framework Directive 2009/128/EC)

EU Strategies, Action Plans etc.

- To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … water…. (Community Strategic Guidelines for Rural Development, 2007 – 2013 2006/144/EC).

Water Availability

International Conventions

- None

EU Legislation

- To promote the sustainable use of water and to mitigate the effects of droughts (Water Framework Directive 2000/60/EC)

EU Strategies, Action Plans etc.

- To introduce policy options to address and mitigate the challenges posed by water scarcity and drought within the Union (Addressing the challenge of water scarcity and droughts in the European Union COM/2007/0414)

Soil Functionality

International Conventions

- None

EU Legislation

- None (although draft Soil Framework Directive under discussion COM(2006) 232)
- To regulate the use of sewage sludge in agriculture in such a way as to prevent harmful effects on soil, vegetation, animals and man (Sewage Sludge Directive 86/276/EEC
- To protect the environment as a whole by preventing or minimising emissions to all media (air, land and water) (IPPC 96/61/EC)

EU Strategies, Action Plans etc.

- To protect and ensure the sustainable use of soil by preventing further soil degradation and restoring degraded soils (Thematic Strategy for Soil Protection COM(2006) 231 Final)
- To promote the sustainable use of soil, with particular attention to preventing erosion, deterioration, contamination and desertification (Sixth Environmental Action Programme 1600/2002/EC)

Climate Stability – Carbon Storage

International Conventions

- To protect and maintain carbon stores (Kyoto Protocol, 1997).

EU Legislation

- None

EU Strategies, Action Plans etc.

- To protect and ensure the sustainable use of soil (Thematic Strategy for Soil Protection COM(2006) 231 Final).

Climate Stability - GHG Emissions

International Conventions

- To reduce atmospheric GHG Emissions (carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_20)) by 8% compared to 1990 levels by 2012 (Kyoto Protocol, 1997) –

NB: Target does not relate solely to agriculture.

EU Legislation

- None

EU Strategies, Action Plans etc.

- To fulfil the commitment of an 8 % reduction in emissions by 2008-12 compared to 1990 levels for the European Community as a whole, in accordance with the commitment of each Member State set out in the Council Conclusions of 16 and 17 June 1998 (Sixth Environmental Action Programme 1600/2002/EC)
- To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … climate change (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC)

Air Quality

International Conventions

- To Abate Acidification, Eutrophication and Ground-level Ozone in accordance with the Gothenburg Protocol (Convention on Long Range Transboundary Air Pollution)

EU Legislation

- To set upper limits for each Member State for the total emissions in 2010 of the four pollutants responsible for acidification, eutrophication and ground-level ozone pollution (sulphur dioxide, nitrogen oxides, volatile organic compounds and ammonia) (National Emissions Ceiling Directive 2001/81/EC).
- To only use authorised plant protection products which are to be supplied properly labelled, with prescriptions for their proper use (Plant Protection Products Directive 92/414/EEC).
- To act in line with detailed rules on the disposal of 9 categories of agricultural waste (Waste Directive 2006/12/EC).
- To protect the environment as a whole by preventing or minimising emissions to all media (air, land and water) (IPPC 96/61/EC)

EU Strategies, Action Plans etc.

- To fulfil the commitment of an 8 % reduction in emissions by 2008-12 compared to 1990 levels for the European Community as a whole, in accordance with the commitment of each Member State set out in the Council Conclusions of 16 and 17 June 1998 (Sixth Environmental Action Programme 1600/2002/EC).

Resilience to Flooding

International Conventions

- None

EU Legislation

- To reduce the probability of flooding and its potential consequences (Floods Directive 2007/60/EC).

EU Strategies, Action Plans etc.

- None

Resilience to Fire

None Identified

ANNEX VI CMEF RESULTS INDICATORS

Annex Table 26 and Annex Table 27 set out the Common Monitoring and Evaluation Framework (CMEF) result indicator targets for Axis 2 measures in the EU-27 showing the area of agricultural land under successful land management contributing to biodiversity, the avoidance of marginalisation, water quality, soil quality and climate change.

Annex Table 26 Result Indicator targets for Axis 2 measures relating to biodiversity and the avoidance of marginalisation

Member State	Area under successful land management contributing to:			
	Biodiversity		Avoidance Marginalisation	
	Result Indicator Target	% of UAA	Result Indicator Target	% of UAA
Austria	2,800,000	86	2,500,000	77
Belgium	155,180	11	58,160	4
Bulgaria	116,000	2	76,750	2
Cyprus	74,786	50	15,610	10
Czech Republic	1,371,000	32	780,000	18
Denmark	493,700	18	No data	No data
Estonia	535,000	65	350,000	43
Finland*	5,615,900	249	2,175,900	96
France*	11,967	0.04	10,502	0.04
Germany	5,759,065	34	5,500,200	32
Greece	2,031,324	51	0	0
Hungary	1,130,000	19	102,000	2
Italy	3,157,035	22	2,089,124	14
Ireland	4,000,000	94	4,000,000	94
Latvia	375,728	9	1,055,000	57
Lithuania	774,000	29	140,000	5
Luxembourg	120,000	92	120,000	92
Malta	293	3	0	0
Netherlands	96,000	5	9,128,290	56
Poland	793,000	5	9,128,290	28
Portugal	760,860	21	1,042,500	28
Romania	5,938,000	43	5,938,000	43
Slovakia	300,000	16	1,140,000	59
Slovenia	373,600	75	300,000	60
Spain	7,488,160	30	7,781,647	31
Sweden	1,500,000	48	1,200,000	38
UK **	2,656,000	16	4,520	27
TOTAL	**4,8426,598**		**54,636,493**	

Source: DG Agriculture and Rural Development data, 2009.
* For Finland, the biodiversity figures are over 100% of UAA due to double counting of multiple agri-environment measures operating on the same parcels. For France, the figures are low due to a strict interpretation of what constituted 'successful management'.
** The figures for the UK are low due to the fact that no data are available for Scotland.

Annex Table 27 **Result Indicator targets for Axis 2 measures relating to water quality, climate change and soil quality.**

	Area under successful land management contributing to:					
Member State	Water Quality		Climate Change		Soil Quality	
	Result Indicator Target	% of UAA	Result Indicator Target	% of UAA	Result Indicator Target	% of UAA
Austria	2, 600, 000	80	1, 200, 000	37	3, 300, 000	102
Belgium	141, 632	10	4, 394	0	119, 414	9
Bulgaria	7, 000	0	118, 000	2	363, 250	7
Cyprus	0	0	0	0	18, 000	12
Czech Republic	436, 000	10	No data	No data	1, 407, 000	33
Denmark	No data	No data	No data	No data	No data	No data
Estonia	500, 000	61	535, 000	65	500, 000	61
Finland*	4, 712, 400	209	4, 212, 400	187	372, 400	17
France*	11, 967	0.04	2, 420	0.01	11, 597	0.04
Germany	5, 576, 880	33	2, 590, 500	15	4, 563, 100	27
Greece	74, 384	2	167, 884	4	1, 913, 634	48
Hungary	0	0	0	0	768, 000	13
Italy	6, 974, 040	48	1, 803, 848	12	2, 563, 697	18
Ireland	4, 000, 000	94	4, 000, 000	94	4, 000, 000	94
Latvia	375, 728	20	375, 728	20	375, 728	20
Lithuania	108, 000	4	174, 000	6	220, 000	8
Luxembourg	120, 000	92	120, 000	92	120, 000	92
Malta	No data	No data	No data	No data	No data	No data
Netherlands	0	0	1, 880	0	0	0
Poland	1, 000, 000	6	0	0	650, 000	4
Portugal	400, 290	11	157, 000	4	1,285, 500	35
Romania	2, 323, 000	17	375, 000	3	1, 159, 660	8
Slovakia	450, 000	23	200, 000	10	250, 000	13
Slovenia	132, 200	26	65, 000	13	96, 000	19
Spain	3,702,820	15	3, 497, 435	14	4, 842, 218	19
Sweden	1, 200, 000	38	Marginal	Marginal	1, 000, 000	32
UK **	1, 294, 100	8	83, 900	1	1, 288, 400	8
TOTAL	36,140,441		19,684,389		25,979,934	

Source: DG Agriculture and Rural Development data, 2009.
* For Finland, the figures are an over-estimate and in certain cases are over 100% of UAA due to double counting of multiple agri-environment measures operating on the same parcels. For France, the figures are low due to a strict interpretation of what constituted 'successful management'.
** The figures for the UK are low due to the fact that no data are available for Scotland.

ANNEX VII AN OVERVIEW OF THE LEGISLATIVE BASELINE AS APPLIED AT FARM LEVEL

The aim of this Annex is to provide an overview of the legislative baseline that applies at farm level that underpins the provision of the ten public goods that form the focus of this study. This legislative baseline at farm level comprises EU legislation and its transposition into legislation at the Member State level as well as other relevant national and/or regional legislation. Some pieces of national and regional legislation have also been incorporated into cross compliance as GAEC standards[26] and where this is known to be the case, this is identified in the relevant table.

The table is not comprehensive. Details are provided for selected Member States, where information is available, and it should be noted that in certain Member States, legislative standards demonstrate a significant level of regional variability, which is not captured in the tables that follow.

[26] Those GAEC Standards that have been introduced as part of cross compliance within selected Member States and which require actions beyond those specified in national or regional legislative requirements are included in Annex X separately.

Annex Table 28 **Details of the EU and selected national legislative requirements at farm level with respect to agricultural landscapes**

EU Directives and Regulations	
See EU Directives and Regulations for Farmland Biodiversity - the Habitats and Birds Directives will also contribute to agricultural landscapes via the requirement to encourage the management of habitats and features of the landscape which are essential for the migration, dispersal and genetic exchange of wild species.	
Legal Requirements (National)	
CZ	No Information provided
DE	German Federal Nature Conservation Act requires the protection of certain landscape features, such as single trees, wetland habitats.
ES	When improving agricultural infrastructures, compliance is required with the Environmental Impact Assessment Regulations (Ley 6/2001, Ley 7/2007)
FR	Decree n°2001-1031 of 8 November 2001 and Ordinance n°2001-321 of 11 April 2001 - authorisation is required before carrying out any work that might affect the habitat.
IT	Code for cultural heritage and landscape (Codice dei beni culturali e del Paesaggio) requires owners in special scenic landscapes to have prior approval for changes to registered properties. Galasso law, 1985 requires all regions to develop landscape protection plans for their whole territory.
RO	No Information provided
SE	Regulation (1998:915) allows the government to require consideration of natural and cultural values, provided this does not seriously interfere with farming; and requires farmers to notify the authorities before taking land out of production. Law (1998:950) provides protection for ancient monuments, and Environmental Code Chapters 1 and 3 for valuable natural and cultural environments, including outdoor recreation areas. Regulation SJVFS 1999 protects landscape features from damage, removal or disposal of farm waste (field roads, stone cairns, headlands, stone walls, traditional wooden fences, alleys, wells, solitary trees, open ditches, obsolete field buildings and historic relics). Cultivation and fertilisation of meadow or pastureland is prohibited if it would damage natural or cultural values. Trees that had an historic purpose must be retained when clearing

	meadow or pastureland. Fertilisers spread on arable land must reach beyond the field. Environmental Code Chapter 7 permits the designation of areas as nature reserves, protected biotopes (or of objects as ‘nature memories’), and restrictions and requirements may be placed on land use within these areas.
UK (England)	On Sites of Special Scientific Interest, the Wildlife and Countryside Act 1981 (amended by CROW and NERC Acts) requires land managers to seek consent for potentially damaging activities (listed when the site is designated) and to comply with any management notices [also GAEC standard]. Hedgerow Regulations – protect ‘important’ hedgerows from removal – defined according to biodiversity and landscape / historical criteria [also GAEC standard]. Tree Preservation Orders and Felling Licences – protects certain trees and requires consent before any work or felling is carried out; replacement planting is usually required [also GAEC standard]. Environmental Impact Assessment – authorisation is required for any agricultural improvement work affecting more than 2 ha of semi-natural habitats (including water) or land that has not been cultivated for15 years (authorities can require approval for smaller areas too) [also GAEC standard]. Heather and Grass etc. Burning (England) Regulations 2007 - burning of rough grass, bracken, gorse, heather and other dwarf shrubs restricted to 1 Nov - end of Mar (uplands) and 1 Oct - 15 Apr (other land) [also GAEC standard]. Ancient Monuments and Archaeological Areas Act 1979 and Ancient Monuments (Class Consents) Order 1994 - work affecting Scheduled Monuments requires prior authorisation. Public paths across farmland must be kept free of obstruction and reinstated if ploughing is unavoidable [GAEC standard for ‘visible’ paths only].

Annex Table 29 **Details of the EU and selected national legislative requirements at farm level with respect to farmland biodiversity**

EU Directives and Regulations	
Habitats Directive: Council Directive 92/43/EEC Birds Directive: Council Directive 79/409/EEC [Some articles are included as SMRs under cross-compliance]	
Designation of Special Areas of Conservation (SACs) by Member States under Article 4 of the Habitats Directive (for habitats and species of Community interest), and Special Protection Areas (SPAs) under Article 4 of the Birds Directive (for birds listed in Annex I of the Directive and for migratory species) and establishment of a 'coherent ecological network' of protected sites under Article 3 of the Habitats Directive referred to as the Natura 2000 network. Protection of listed species as well as their breeding sites and resting places, wherever they occur, with a ban on hunting, gathering or sale of certain species of flora and fauna - under the Birds Directive the hunting of certain species is authorised under certain conditions regarding methods used.	
Legal Requirements (National)	
CZ	Act No. 114/1992 Sb on Nature and Landscape protection and Decree 166/2005
DE	Permission required to undertake any activities that may have a significant impact on the environment within a protected area. In some Länder 'protected area regulations' or individual arrangement can place additional requirements on farmers – e.g. ban on ploughing grassland; prevent changes to water levels; retention of landscape features. Federal Nature Conservation Law (BNatShG) requires compliance with specified good agricultural practices so that the natural conditions of the land (soil, water, flora, fauna) are not disturbed more than necessary to achieve a sustainable yield. Hunting Law sets out restrictions on the capture and killing of birds (but there is some regional derogation from national nature conservation law to permit the shooting of crows and magpies outside protected areas and breeding season to avoid severe agricultural damage). Federal Law requires environmental Impact Assessment for pig and poultry units above a minimum size.

	German Federal Nature Conservation Act requires the protection of certain landscape features, such as single trees, wetland habitats.
ES	Fencing of habitats, stubble burning and road construction prohibited. Conservation measures are prescribed for some Natura 2000 areas. Listed birds may be hunted, but not during the breeding season. When improving agricultural infrastructures comply with Environmental Impact Assessment Regulations (Ley 6/2001, Ley 7/2007)
FR	Decree n°2001-1031 of 8 November 2001 and Ordinance n°2001-321 of 11 April 2001 Authorisation is required before carrying out any work that might affect the habitat.
IT	Protection measures set up and specific management plans developed for a proportion of SACs. In the absence of regional regulations and management plans, farmers must follow GAEC standards for stubble management, permanent pasture, fallow and landscape features. (Infringement proceedings initiated by the Commission in 2006 regarding incorrect implementation of the Birds Directive). In Veneto the Regional Land Use Coordination Plan designates 405 of the territory as Regional Ecological Networks (REN) (DGR 2587/07; DGR 2357/08; DGR 372/09).
RO	Law no. 462 of July 18, 2001
SE	Permission required to undertake any activities that may have a significant impact on the environment within a protected area. Regulation (1998:915) allows the government to require consideration of natural and cultural values, provided this does not seriously interfere with farming; and requires farmers to notify the authorities before taking land out of production. Law (1998:950) provides protection for ancient monuments, and Environmental Code Chapters 1 and 3 for valuable natural and cultural environments, including outdoor recreation areas. Regulation SJVFS 1999 protects landscape features from damage, removal or disposal of farm waste (field roads, stone cairns, headlands, stone walls, traditional wooden fences, alleys, wells, solitary trees, open ditches, obsolete field buildings and historic relics). Cultivation and fertilisation of meadow or pastureland is prohibited if it would damage natural or cultural values. Trees that had an historic purpose must be retained when clearing meadow or pastureland. Fertilisers spread on arable land must reach beyond the field. Environmental Code Chapter 7 permits the designation of areas as nature reserves, protected biotopes (or of objects as 'nature memories'), and restrictions and

	requirements may be placed on land use within these areas.
UK (England)	All Natura 2000 sites are designated as Sites of Special Scientific Interest and land management is regulated by the relevant national laws (see below). Scientific Interest, the Wildlife and Countryside Act 1981 (amended by CROW and NERC Acts) requires land managers to seek consent for potentially damaging activities (listed when the site is designated) and to comply with any management notices [also GAEC standard]. Hedgerow Regulations – protect 'important' hedgerows from removal – defined according to biodiversity and landscape / historical criteria. [also GAEC standard] Tree Preservation Orders and Felling Licences – protects certain trees and requires consent before any work or felling is carried out; replacement planting is usually required [also GAEC standard]. Environmental Impact Assessment – authorisation is required for any agricultural improvement work affecting more than 2 ha of semi-natural habitats (including water) or land that has not been cultivated for15 years (authorities can require approval for smaller areas too) [also GAEC standard]. Heather and Grass etc. Burning (England) Regulations 2007 - burning of rough grass, bracken, gorse, heather and other dwarf shrubs restricted to 1 Nov - end of Mar (uplands) and 1 Oct - 15 Apr (other land) [also GAEC standard]. Crop Residues (Burning) Regulations 1993 prohibit burning of cereal and other crop residues, and prescribe conditions for permitted burning (e.g. of linseed residue) [also GAEC standard]. Weeds Act 1959 requires farmers to prevent the spread of five 'injurious' weeds [also GAEC standard].

Annex Table 30 Details of the EU and selected national legislative requirements at farm level with respect to water quality

EU Directives and Regulations	
Nitrates Directive: Council Directive 91/676/EC [SMR under cross-compliance] [27]	
Member States must set up 'action programmes' for reducing the pollution of water bodies, either in defined Nitrate Vulnerable Zones, which may concern the whole territory of certain Member States (Austria, Denmark, Finland, Germany, Ireland, Luxemburg, Lithuania, the Netherlands and Slovenia have taken this option). Action programmes specify when and how much fertiliser may be used, the minimum storage capacity for manure, and set limits for fertiliser application on steep sloping grounds and alongside watercourses. At farm level, no more than 170kg of nitrogen from livestock manure may be applied per hectare per year (but there have been derogations from this limit for some farms, for example in the Netherlands, Denmark, Germany and the UK in accordance with criteria set out in the Directive).	
CZ	Government Order 108/2008 amending Government Order No 103/2003. Within NVZs specifies manure storage capacities, and limitations on timing, location and quantities of fertilisers which may used. N limits are, for example 200 kg/ha on grassland, 220 kg/ha on winter wheat, 120 kg/ha on poppy seed.
DE	*Düngeverordnung, DüV* (code of practice) and *JGS-Anlagenverordnungen* (manure storage). Applies across whole country (no NVZs in Germany) with regional variations (not included within this table). Manure storage capacity at least 6 months. No fertilisation 1 Nov-31 Jan on arable land, 15 Nov-31 Jan on grassland, or on frozen, snow-covered or water-logged soil, or within a minimum of 3m of watercourses (1m with precision spreader), or within 20m of top of bank on slopes >10%. Nutrient management planning, with compulsory soil analysis for P. Limitations on types of spreader used. On uncultivated land liquid manures and fertilisers must be incorporated immediately. Post harvest applications <40kg ammonia-N or <80kd/ha liquid or poultry manure. Record keeping includes input/output budgets for N and P. (Germany has derogation from 170kg/ha/year N limit to 250kg/ha/year for intensive grassland, only uses it on a very small proportion of UAA)
ES	Within NVZs requirements vary regionally. For example: manure and sludge prohibited within 50m of watercourses (elsewhere buried). Limitations on use of ammonia and urea. Fertilisation prohibited within 10m of watercourses (50 m for liquid fertilisers); in rainy periods, on frozen, snow-covered or water-logged soil; on slopes > 10% (unless done without N run-off); in non-cultivated areas (unless green cover, or will be sown within 15 days). On windy days no application within 50 m of watercourses. Top dressing must be split into two applications. On fallow land no more than 20 tonnes manure or 40m^3 per ha over a 3 year period.

[27] It should be noted that the information on national implementation of the Nitrates Directive is not comprehensive and does not include all aspects of the Nitrates Action Plans that are implemented within Member States.

FR	Decree n°93-108 of 27 august 92, Decree n°2001-34 (10 January 2001) and ministerial decree of 6 March 2001 Within NVZs requirements vary regionally, and include: manure storage capacity; obligatory nutrient management planning and record keeping; spreading prohibited near watercourses, and during specified periods; additionally, in areas of high N pollution, green cover in winter is compulsory.
IT	Decreto 7 April 2006, establishing measures to be applied within and outside NVZs. Requirements vary regionally. For example: no spreading of organic manures 1 Nov- 28 Feb; nutrient management planning; regional authorities must be notified of transport and spreading of N fertilisers and organic manures. Fertiliser application prohibited close to watercourses, on slopes higher than 10% and on snow covered, frozen and saturated ground.
RO	Order no. 1270 of 30.11.2005 – no further information provided
SE	Within NVZs: Manure storage capacity 6-8 months; farms with >10LU must have minimum spreading area; no mineral fertilisers applied 1 Nov - 15 Feb. Manure applied only 1 Aug – 30 Nov (some exceptions), and not on waterlogged or frozen soil (except grass leys after 28 Feb). Limit of 22kg P per ha per year. Nutrient management planning.
UK (England)	Nitrate Pollution Prevention Regulations (SI 2008/2349) Within NVZs: 5-6 months manure storage capacity; spreading some organic manures (e.g. slurry, poultry manure) prohibited during periods of 3 – 5 months, and N fertilisers during specified periods unless there is a crop nitrogen requirement. Nutrient management planning (N maximum limits). Written assessment to identify land at risk of runoff; where risk is high fertilisation prohibited. High trajectory application of slurry prohibited; organic manure applied to bare soil or stubble may require incorporation. Compulsory record keeping of all N applications and livestock numbers. (UK has derogation from 170kg/ha/year limit to 250kg/ha/year in certain circumstances).
Water Framework Directive: Directive 2000/60/EC of the European Parliament and of the Council	
The farm level actions to achieve the objectives for each river basin will overlap to a significant extent with those already in place for the Nitrates Directive, and any additional regulatory requirements are likely to be part of the programme measures for each river basin district which Member States must have identified by October 2009 and used to achieve the objectives by 2015. Details of these were not available for this study.	
Sewage Sludge Directive: Council Directive 86/278/EEC [SMR under cross compliance]	
Use of sewage sludge on farm land forbidden in certain areas, and under certain conditions	
CZ	Law No. 185/2001 on wastes as amended and Public notice No. 382/2001 requires sludge producer to design and implement a programme of use. Sewage sludge is prohibited on agricultural land in protected areas, in areas to safeguard water sources, on waterlogged and floodplain soils, and on certain crops.
DE	Analysis of both sludge and soil required, use on soils <pH5, permanent grassland and some protected areas is prohibited. Only treated sludge permitted, with limited heavy metal content. No more than 5t/ha dry matter (10t/ha for composted sludge) in 3 year period. Must be deeply

	incorporated before sowing fodder crops. Nutrients in sludge must be included in N balance (see Nitrates Directive).
ES	Real Decreto 1310/1990: Use of untreated sludge prohibited.
FR	Decree n°97-1133 of 8 December 1997: Authorisation and contract obligatory.
IT	Treated sludge (only) may be used, with authorisation, documentation and prior notification to authorities. Restrictions on use on certain soils, steep slopes and for forage crops.
RO	No information provided.
SE	Naturvårdsverkets Kungörelse (SNFS 1994:2): Treated and untreated sludge may be used (detailed requirements apply to both).
UK (England)	Sludge (Use in Agriculture) Regulations 1989 Analysis of both sludge and soil required, heavy metal limits must be respected, application must be relative to crop needs and is prohibited on soils <pH5. Untreated sludge must be incorporated as soon as possible. Restrictions on use on certain crops.
Groundwater Directive: Council Directives 80/68/EEC and 2006/118 [SMR under cross compliance]	
No pollution of groundwater permitted by disposing of listed substances unless prior permission obtained.	
CZ	No information provided.
DE	Controls on storage and handling of dangerous materials.
ES	Ley 29/1985: Listed substances must be managed separately from phytosanitary products, and fertilisers, and storage and disposal requires prior authorisation
FR	No information provided
IT	Authorisation required for direct discharge to water or sewage.
RO	Government Decision HG no. 783/2006, HG nr. 210/2007, HG 351/2005, Water Law no. 107/1996 – no further information provided
SE	SNFS (1996:11) 4, 6 requires the farmer to ensure that the following substances do not risk contaminating groundwater: organic halogen compounds and substances that can make such compounds in aquatic environments; organic phosphorous compounds, organic tin compounds, substances that may cause cancer, mutations or foetal damage in or by the aquatic environment, mercury and its compounds, cadmium and its compounds, mineral oils and hydrocarbons, cyanides.
UK (England)	Groundwater Regulations 1998 require prior written authorisation for disposal of some substances on land (e.g. sheep dip), and conditions may be set.

Plant Protection Products Regulation: Regulation (EC) No 1107/2009 of the European Parliament and of the Council	
Plant protection products must be approved and used properly, including compliance with the conditions on the labelling, and with the principles of good plant protection practice as well as, whenever possible, the principles of integrated control[28].	
CZ	No information provided
DE	Federal Law requires application only by skilled operators, using appropriate equipment, and keeping records of applications.
ES	Real Decreto 2163/1994: Use only approved products, and have authorisation to use them. Observe 'best-before' date, follow code of practice (Real Decreto 280/1994), and attend at least 80% of appropriate training course.
FR	Decree n°94-359 of 5 May 1994, and Decree n°2001-317 of 4 April 2001: Use only approved products, comply with labelling, keep records. No spray zones required.
IT	Use only approved products, comply with labelling, keep records.
RO	No information provided
SE	Miljöbalken 14 kap: Use only approved products in accordance with good practice, comply with labelling and keep records.
UK (England)	Use only approved products and comply with labelling (record keeping is covered by SMR 11, on Food Law).
Pesticides Framework Directive: Directive 2009/128/EC of the European Parliament and of the Council	
This Directive has only recently entered into force and requires Member States to introduce National Action Plans, coordinated with implementation plans under other relevant Community legislation, aimed at: • setting quantitative objectives, targets, measures, timetables and indicators to reduce risks and impacts of pesticide use on human health and the environment; and • encouraging the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides. Member States are also required to monitor the use of plant protection products containing active substances of particular concern and to establish timetables and targets for the reduction of their use.	
Integrated pollution prevention and control (IPPC) Directive: Directive 2008/1/EC of the European Parliament and of the Council	

[28] National information relates to the previous Plant Protection Products Directive (91/414/EEC) which has recently been repealed by Regulation 1107/2009

(See Air Quality)	
Legal Requirements (National)	
CZ	No information provided
DE	Water Law in Land of BW No ploughing of grassland permitted in riparian zones. Within water protection areas obligatory land management practices are set out (i.e. no removal of trees/scrub; no cultivation within 10m of a water course). Federal Fertilisation Law (*Düngeverordnung, DüV)* sets maximum permitted N and P surpluses, in addition to the requirements of the Nitrates Directive. Federal Laws on plant protection, pesticides, and protection of bees. Federal Laws on soil protection in areas of erosion risk used for agriculture. Other regulations exist at Länder level e.g. Water Law in Land of BW No ploughing of grassland permitted in riparian zones. Within these and groundwater protection areas (three types) obligatory land management practices are set out and compensation is provided.
ES	No information provided
FR	National Law 64-1245 and 92-3 sets up three water catchment protection zones with activities regulated within zones. National Laws 2004-338 and 2006-1772 require plant protection sprayers to be officially inspected.
IT	No information provided
RO	No information provided
SE	No information provided
UK (England)	The Control of Pollution Regulations 1991 control the construction of facilities for making and storing silage, storing effluent and agricultural fuel oil. Water Resources Act, 1991 (A.85) – offence to cause or knowingly permit polluting or waste matter into controlled waters.

Annex Table 31 Details of the EU and selected national legislative requirements at farm level with respect to water availability

EU Directives and Regulations	
Water Framework Directive: Directive 2000/60/EC of the European Parliament and of the Council	
The farm level actions to achieve the objectives for each river basin will in some case cover abstraction and use of water, and any additional regulatory requirements are likely to be part of the programme of measures for each river basin district which Member States must have identified by October 2009 and used to achieve the objectives by 2015. As these programmes of measures are not yet in force, it is not possible to look at these at the Member State level.	
Legal Requirements (National)	
CZ	No information provided
DE	No information provided
ES	In the event of land that is irrigated by water coming from aquifers that have been legally declared as over-used, the farmer shall have to prove he/she is entitled to use such water by the competent authority. Farmers are obliged to install and maintain irrigation water measurement systems set out by the respective river basin bodies.
FR	No information provided
IT	National law requires authorisation for use of water for irrigation
RO	No information provided
SE	No information provided
UK (England)	Water Act 2003 – abstraction from groundwater for agricultural use requires a licence. Abstraction from surface water requires a licence if it is for spray irrigation, or is > 20m^3 per day. Under common law, farmers and with land adjacent to a watercourse have responsibilities as the 'riparian owner', including passing on the flow without affecting the rights of others to receive water in its natural quantity and quality.

Annex Table 32 **Details of the EU and selected national legislative requirements at farm level with respect to soil functionality**

EU Directives and Regulations	
Nitrates Directive: Council Directive 91/676/EC [SMR under cross-compliance]	
(See Water Quality)	
Groundwater Directive: Council Directives 80/68/EEC and 2006/118 [SMR under cross compliance]	
(See Water Quality)	
Plant Protection Products Regulation: Regulation (EC) No 1107/2009 of the European Parliament and of the Council	
(See Water Quality)	
Sewage Sludge Directive: Council Directive 86/278/EEC [SMR under cross compliance]	
(See Water Quality)	
Pesticides Framework Directive: Directive 2009/128/EC of the European Parliament and of the Council	
(See Water Quality)	
Integrated pollution prevention and control (IPPC) Directive: Directive 2008/1/EC of the European Parliament and of the Council	
(See Air Quality)	
Proposed Soil Framework Directive (COM(2006) 232)	
It is proposed that Member States should use common parameters to identify areas at risk of erosion, organic matter decline, salinisation, compaction and landslides and then establish national programmes of measures to deal with these risks, including requirements for land users to take precautionary measures when their use of the soil can be expected to significantly hamper soil functions.	
Legal Requirements (National)	
CZ	(See Water Quality and Biodiversity)

DE	(See Water Quality and Biodiversity)
ES	(See Water Quality and Biodiversity)
FR	(See Water Quality and Biodiversity)
IT	(See Water Quality and Biodiversity)
RO	(See Water Quality and Biodiversity)
SE	(See Water Quality and Biodiversity)
UK (England)	(See Water Quality and Biodiversity)

Annex Table 33 Details of the EU and national legislative requirements at farm level with respect to carbon storage

EU Directives and Regulations	
None	
Legal Requirements (National)	
CZ	No information
DE	No information
ES	No information
FR	No information
IT	No information
RO	No information
SE	No information
UK (England)	No information

Annex Table 34 Details of the EU and national legislative requirements at farm level with respect to GHG emissions

EU Directives and Regulations	
National Emission Ceilings Directive: Directive 2001/81/EC of the European Parliament and of the Council	
The Directive was introduced because significant areas of the EU were exposed to depositions of acidifying and eutrophying substances at levels with adverse effects on the environment, and WHO guideline values for the protection of human health and vegetation from photochemical pollution were substantially exceeded in all Member States. The Directive sets interim environmental objectives for acidification and ground-level ozone pollution, and Member State have drawn up programmes for the progressive reduction of national emissions of sulphur dioxide (SO_2), nitrogen oxides (NOx), volatile organic compounds (VOC) and ammonia (NH_3), to achieve the target levels set in the Directive by the end of 2010 at the latest. Of these four pollutants agriculture makes significant contributions to nitrogen oxides and ammonia, from the storage and use of livestock manure and mineral N fertilisers, in addition to pollutants from use of fossil fuels. The Directive does not require specific farm-level action, but some of the requirements arising from the Nitrates Directive, and additional national legislation on fertiliser use and manure storage will also have an impact on NOx and ammonia emissions (see Water Quality).	
Nitrates Directive: Council Directive 91/676/EC [SMR under cross-compliance]	
(Nitrates Directive likely to have indirect effect through reduction in nitrification)	
Legal Requirements (National)	
CZ	No information
DE	No information
ES	No information
FR	No information
IT	No information
RO	No information
SE	No information
UK (England)	No information

Annex Table 35 Details of the EU and national legislative requirements at farm level with respect to air quality

EU Directives and Regulations
Integrated pollution prevention and control (IPPC) Directive: Directive 2008/1/EC of the European Parliament and of the Council
The only farm level agricultural activities covered by the IPPC Directive are intensive pig and poultry units with a high pollution potential, defined as those with more than: 40 000 places for poultry; 2 000 places for production pigs (over 30 kg); or 750 places for sows. Information was not collected from individual Member States, but it is a requirement of the Directive that each unit must have a permit, issued only if certain environmental conditions are met. In particular the production unit must: • use all appropriate pollution-prevention measures, namely the best available techniques (which produce the least waste, use less hazardous substances, enable the substances generated to be recovered and recycled, etc.) • prevent all large-scale pollution; prevent, recycle or dispose of waste in the least polluting way possible; • use energy efficiently; • ensure accident prevention and damage limitation; • return sites to their original state when the activity is over. The permit must contain a number of specific requirements, including: • emission limit values for polluting substances (with the exception of greenhouse gases if the emission trading scheme applies - see below) • any soil, water and air protection measures required; • waste management measures; • measures to be taken in exceptional circumstances (leaks, malfunctions, temporary or permanent stoppages, etc); • minimisation of long-distance or transboundary pollution; • release monitoring; • all other appropriate measures.

National Emission Ceilings Directive: Directive 2001/81/EC of the European Parliament and of the Council	
(see Reduced GHG emissions)	
(Nitrates and PPP Directives likely to have indirect effects – see Water Quality)	
Legal Requirements (National)	
CZ	(See Water Quality)
DE	(See Water Quality)
ES	(See Water Quality)
FR	(See Water Quality)
IT	(See Water Quality)
RO	(See Water Quality)
SE	(See Water Quality)
UK (England)	(See Water Quality)

Annex Table 36 Details of the EU and national legislative requirements at farm level with respect to resilience to flooding

EU Directives and Regulations	
Floods Directive: Directive 2007/60/EC of the European Parliament and of the Council	
Member States are required to take adequate and coordinated measures to reduce flood risk, and these will be implemented in coordination with the Water Framework Directive, notably by flood risk management plans and river basin management plans being coordinated.	
Legal Requirements (National)	
CZ	No information
DE	By 2012 Länder will implement regulations to reduce erosion and improve flood storage capacity.
ES	No information
FR	No information
IT	No information
RO	No information
SE	No information
UK (England)	Common Law Farmers and landowners with property or land adjacent to a river or other watercourse have a number of responsibilities as the 'riparian owner', but not specifically related to agricultural land.

Annex Table 37 Details of the EU and national legislative requirements at farm level with respect to resilience to fire

EU Directives and Regulations	
None	
Legal Requirements (National)	
CZ	No information
DE	No information
ES	No information
FR	No information
IT	No information
RO	No information
SE	No information
UK (England)	No information

ANNEX VIII THE INTERVENTION LOGICS OF SELECTED POLICY MEASURES

Included below are Intervention Logics setting out the objectives of the main policy measures within the Common Agricultural Policy that have the potential to support the provision of public goods, as well as those of the LIFE+ programme. These have been developed to aid the analysis of the impacts of these measures on the delivery of public goods which forms the focus of Chapter 5. The following measures have been included:

Pillar 1

Single Payment Scheme and the Single Area Payment Scheme

Article 68

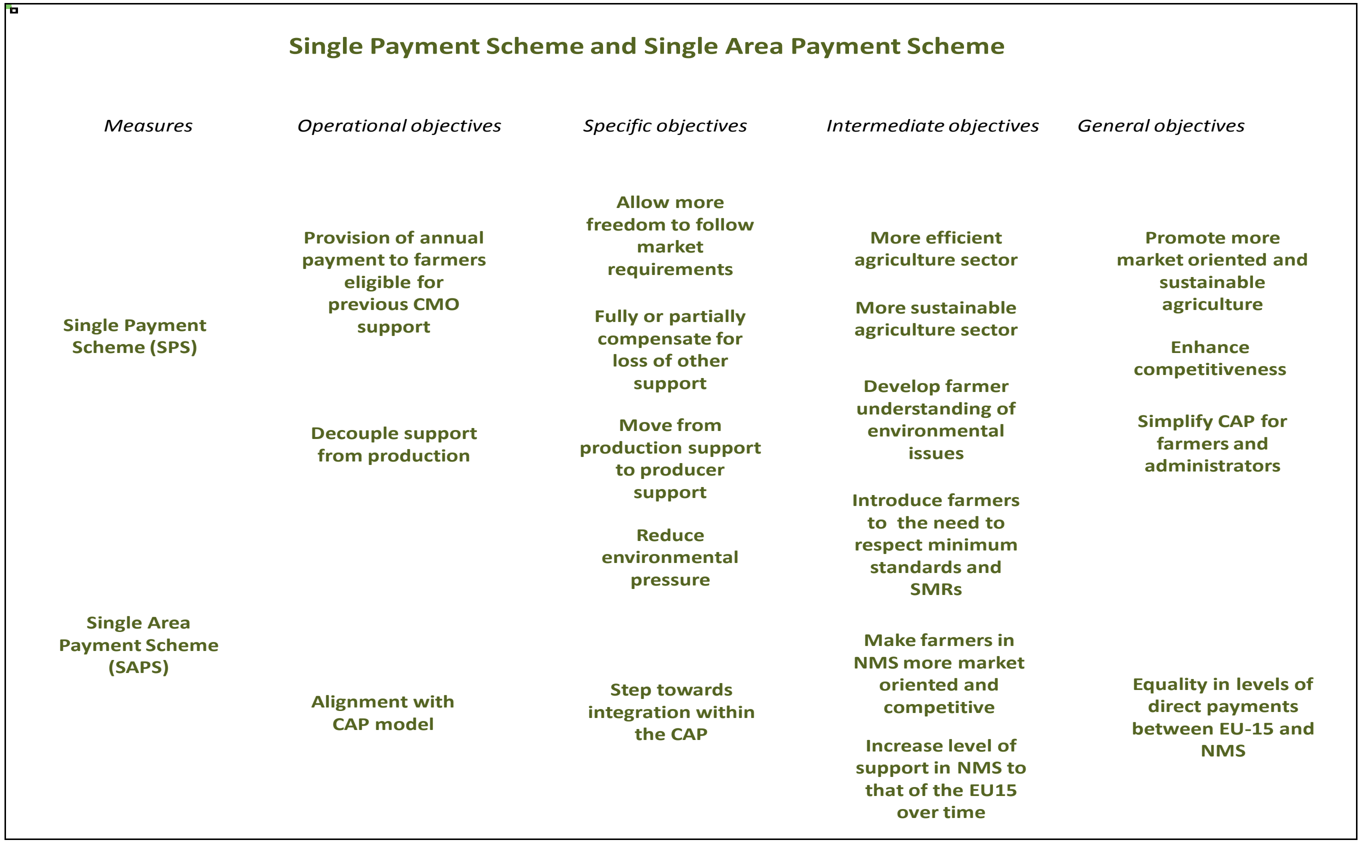
Cross Compliance

Pillar 2

Measure 111	*Training*
Measure 114	*Advice Provision*
Measure 121	*Farm Modernisation*
Measures 211 and 212	*Natural Handicap Payments*
Measure 213	*Natura 2000 and Water Framework Directive*
Measure 214	*Agri-Environment Payments*
Measure 311	*Farm Diversification*
Measure 323	*Conservation and Upgrading of Rural Heritage*

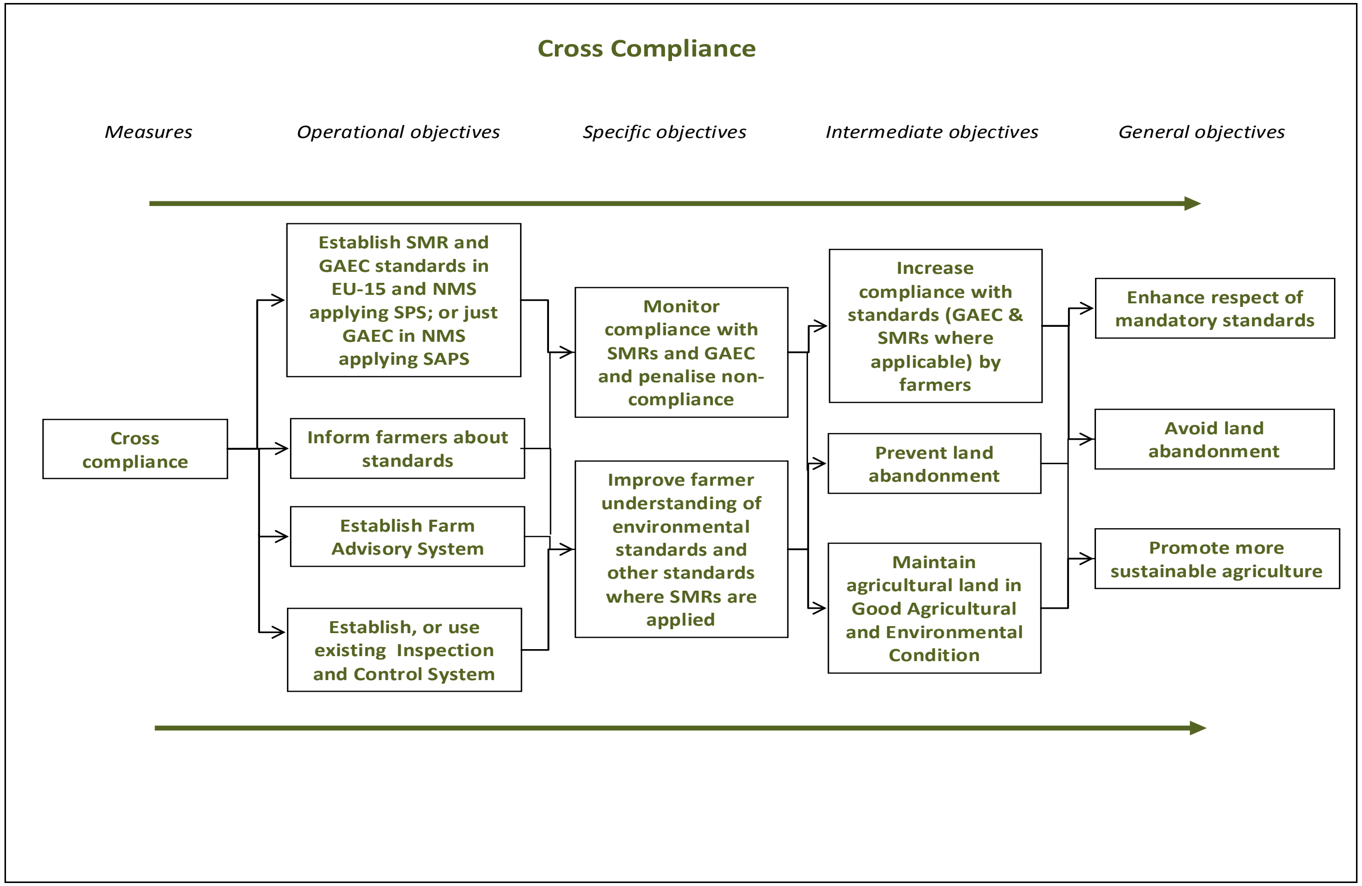
LIFE + Programme

CAP - Pillar One



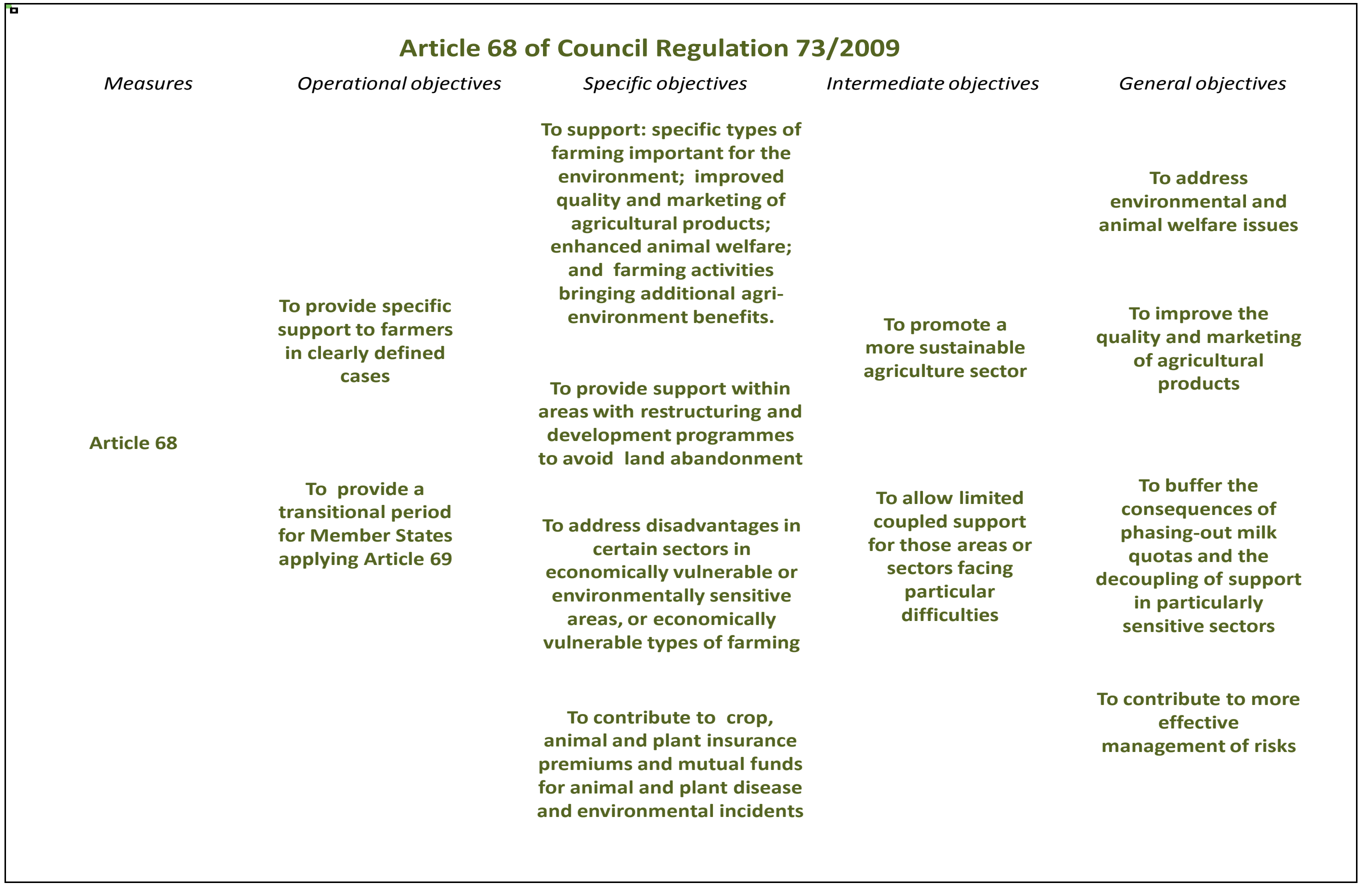
Annex Figure 11 Intervention Logic for the Single Payment Scheme (SPS) and the Single Area Payment Scheme (SAPS)

Source: Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers (OJ L 30/16, 31.01.2009), amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003.



Annex Figure 12 Intervention Logic for Cross Compliance

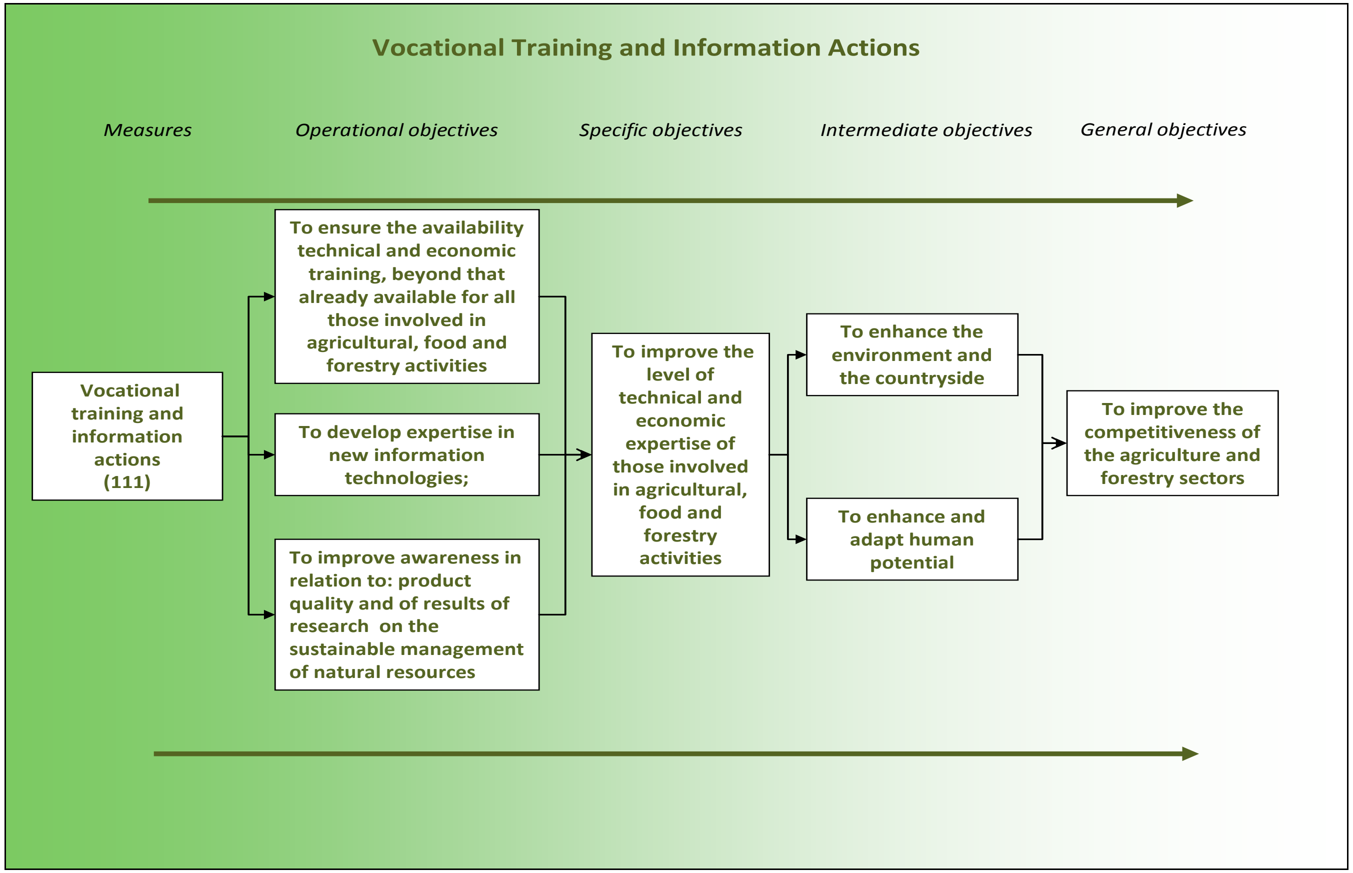
Source: Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers (OJ L 30/16, 31.01.2009), amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003.



Annex Figure 13 Intervention Logic for ‘Specific Support’ under Article 68 of Council Regulation 73/2009

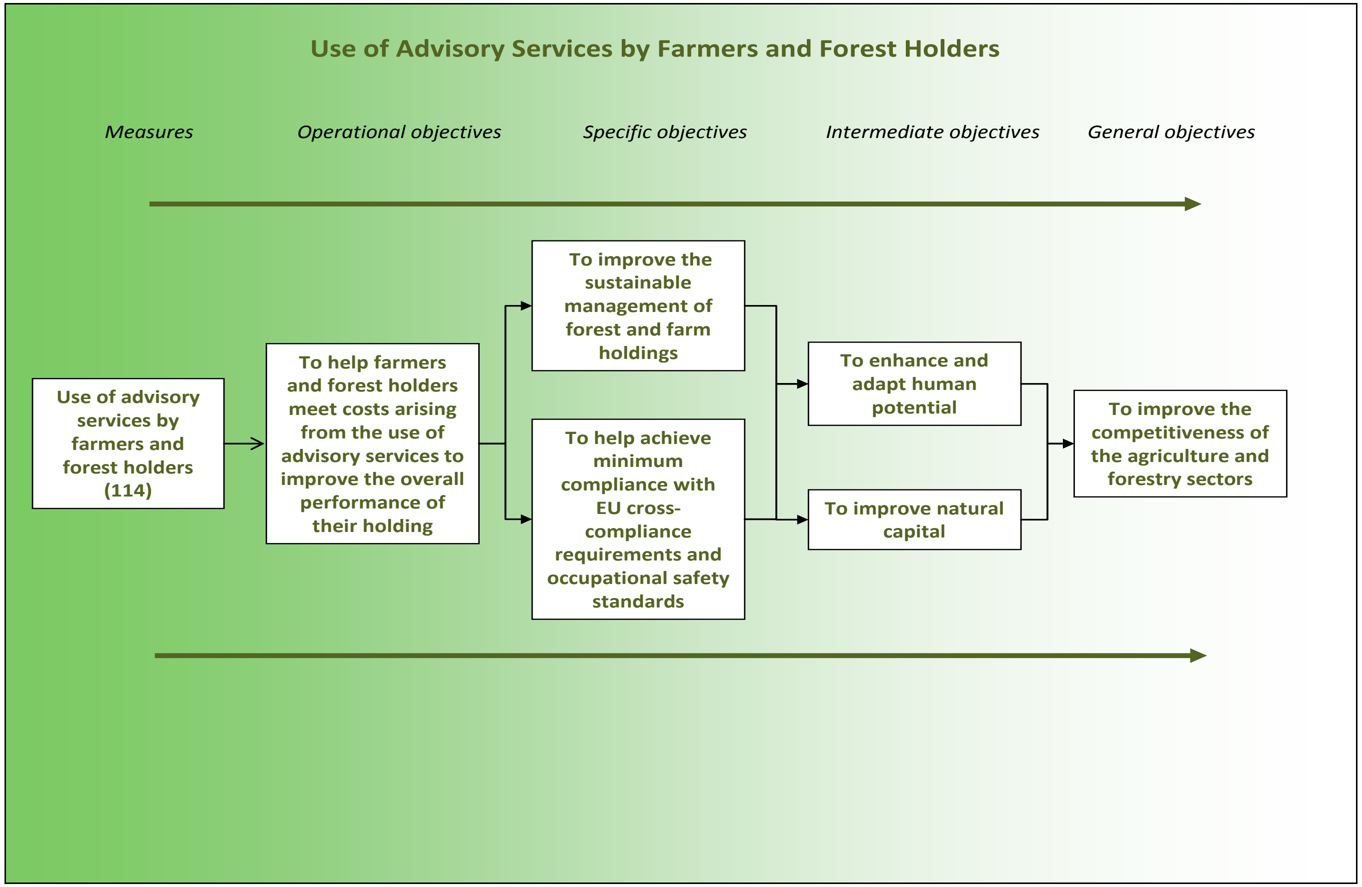
Source: Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers (OJ L 30/16, 31.01.2009), amending Regulations (EC) No 1290/2005, (EC) No 247/2006, (EC) No 378/2007 and repealing Regulation (EC) No 1782/2003.

CAP - Pillar Two (EAFRD)



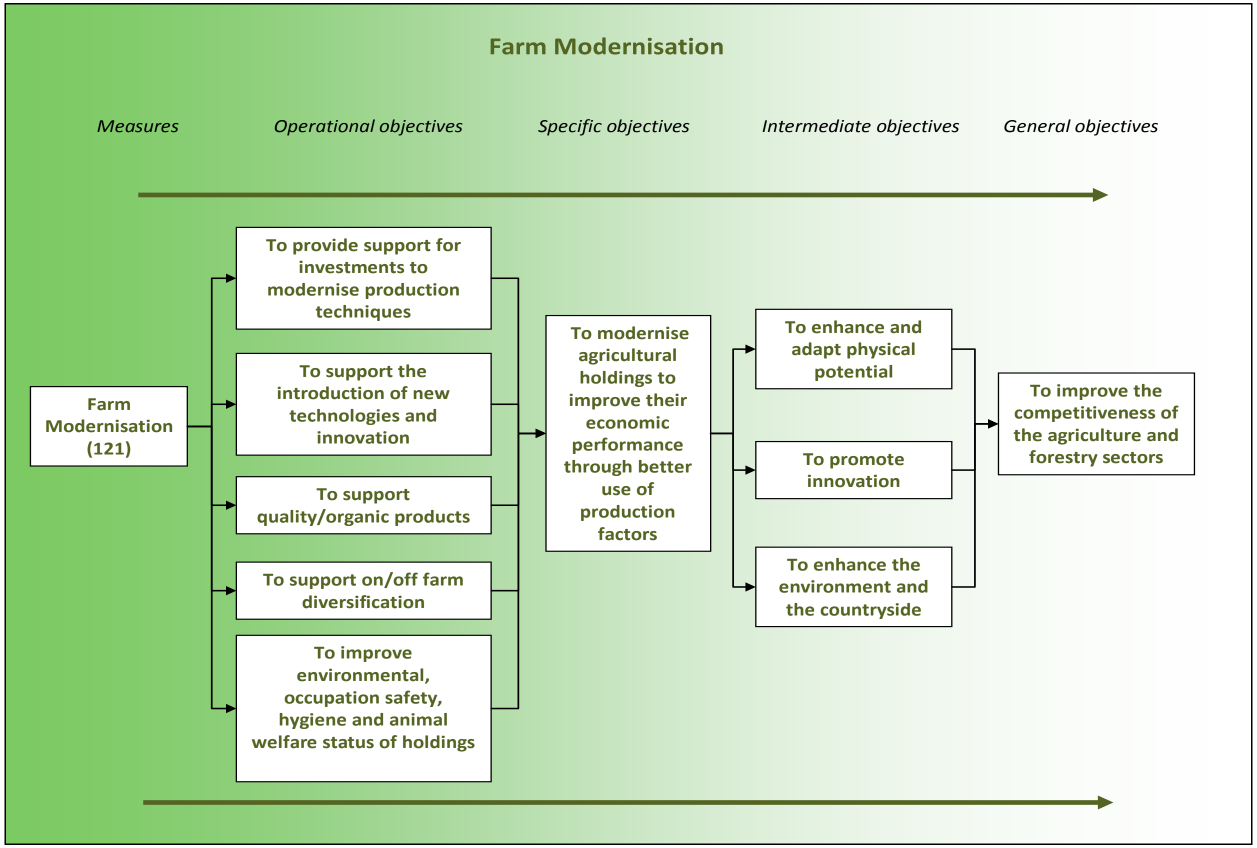
Annex Figure 14 Intervention Logic for vocational training and information actions (111)

Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.



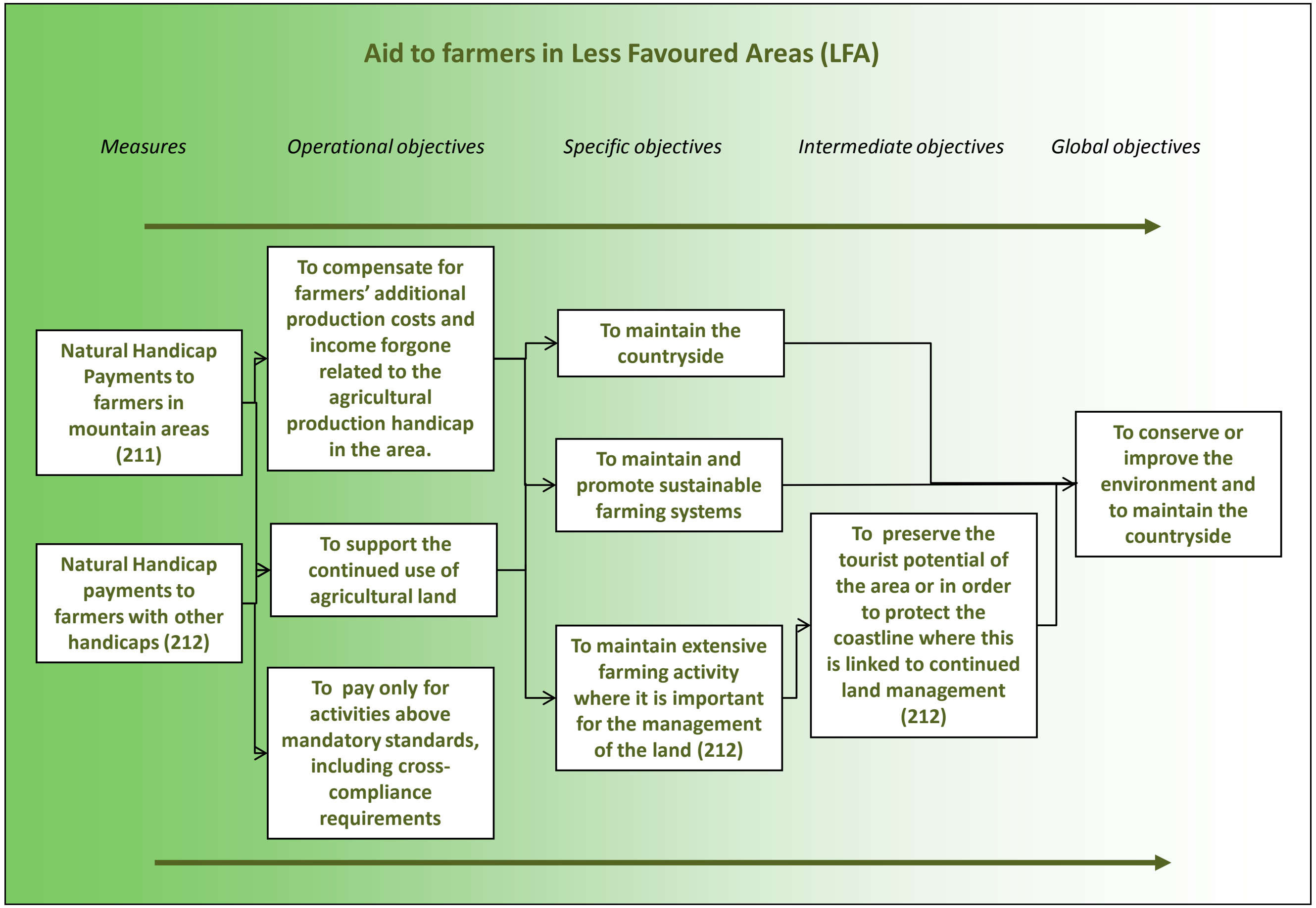
**Annex Figure 15	Intervention Logic for the use of advisory services by farmers and forest holders (114)**

Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.



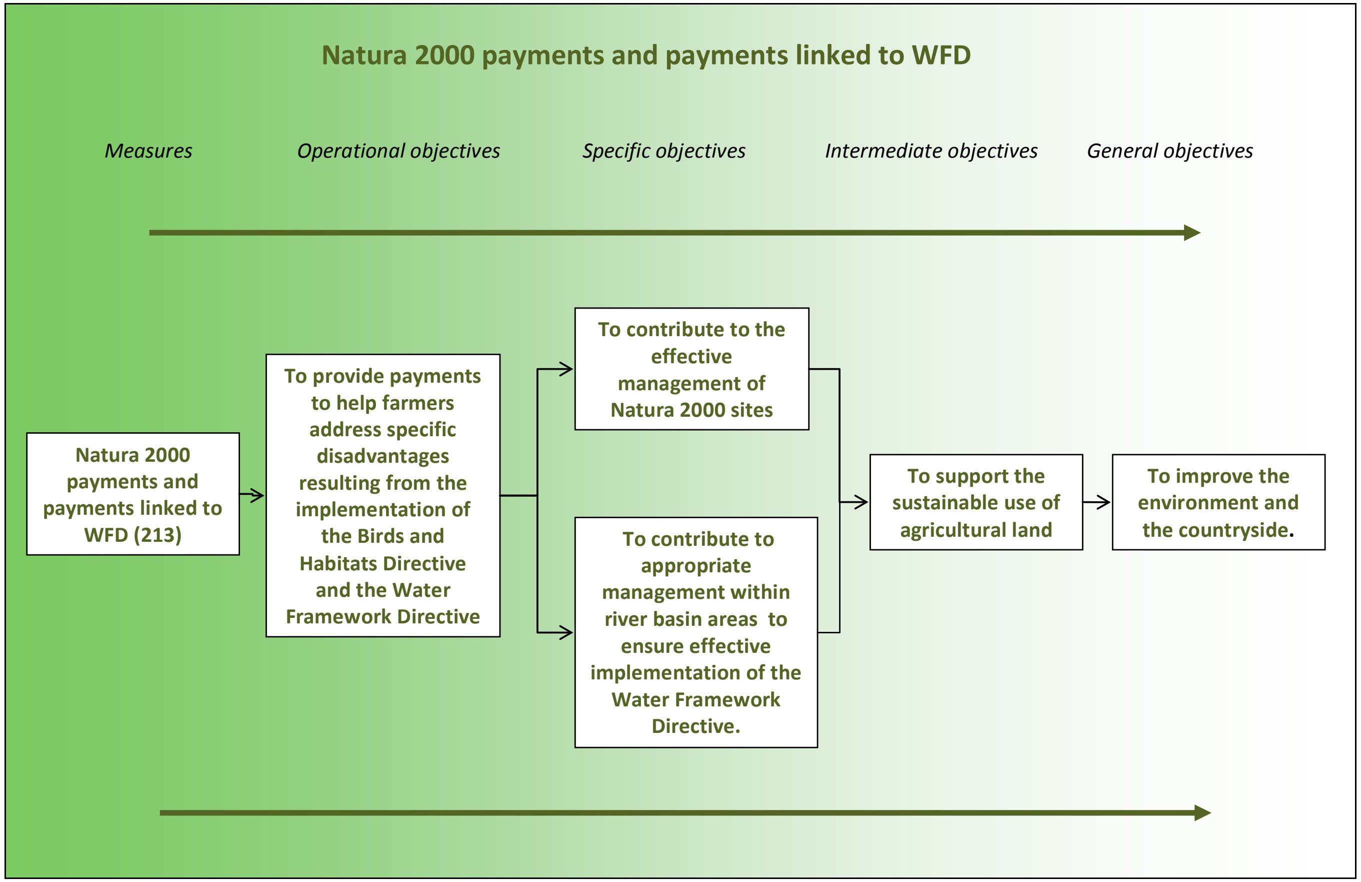
Annex Figure 16 Intervention Logic for farm modernisation (121)

Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.



Annex Figure 17 Intervention Logic for Natural Handicap Payments (211, 212)

Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.



Annex Figure 18 **Intervention Logic for Natura 2000 payments and payments linked to the Water Framework Directive (213)**

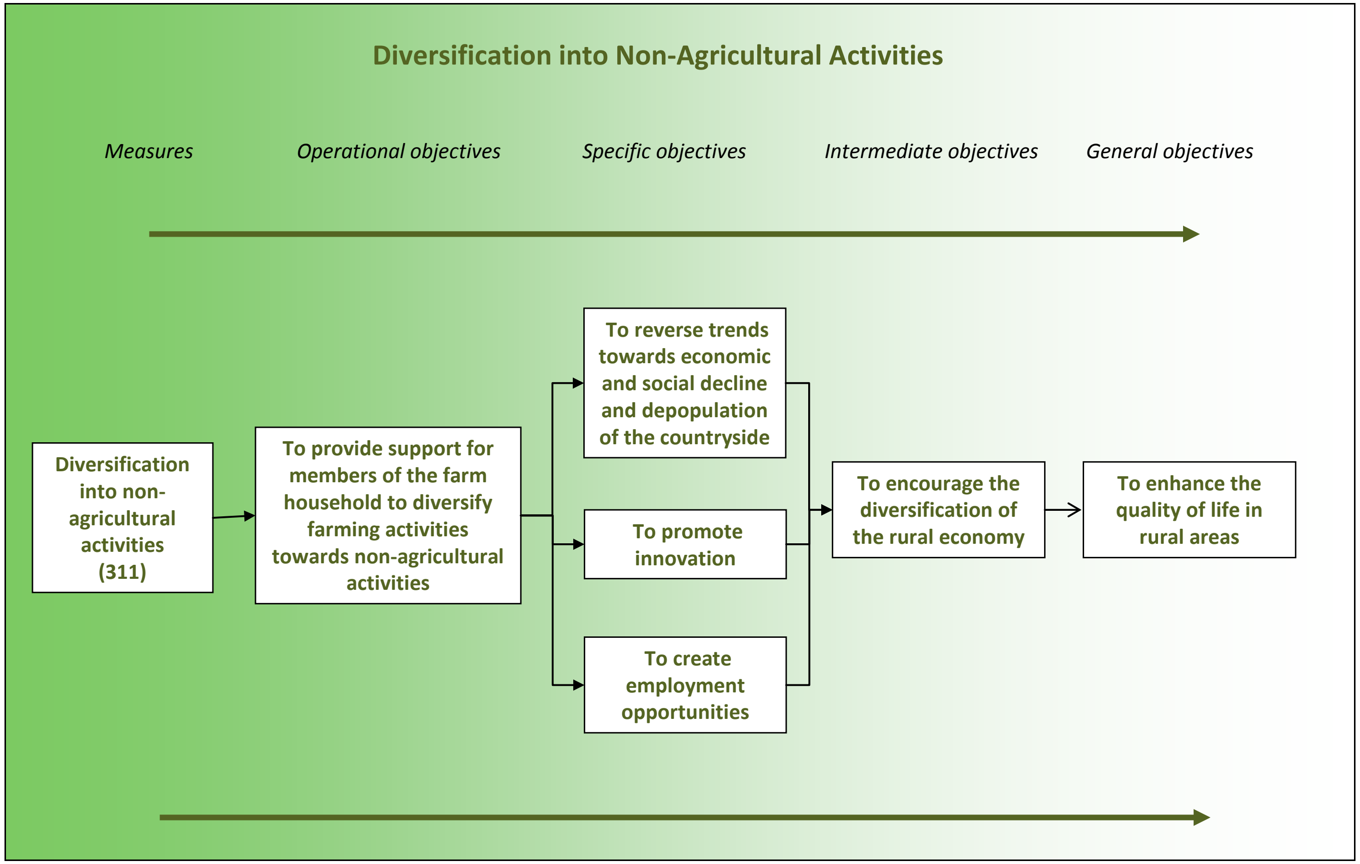
Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.

Agri-environment payments

Measures	*Operational objectives*	*Specific objectives*	*Intermediate objectives*	*General objectives*
Agri-environment (214)	**To encourage farmers and other land managers to introduce or maintain production methods compatible with the protection of the environment, landscape and its features, natural resources, the soil and genetic diversity**	**To support the sustainable development of rural areas**	**To support the sustainable use of agricultural land**	**To improve the environment and the countryside**
		To support the provision of public goods associated with agriculture		
	To pay only for activities above mandatory standards, including cross-compliance requirements	**To respond to society's increasing demand for environmental services**		

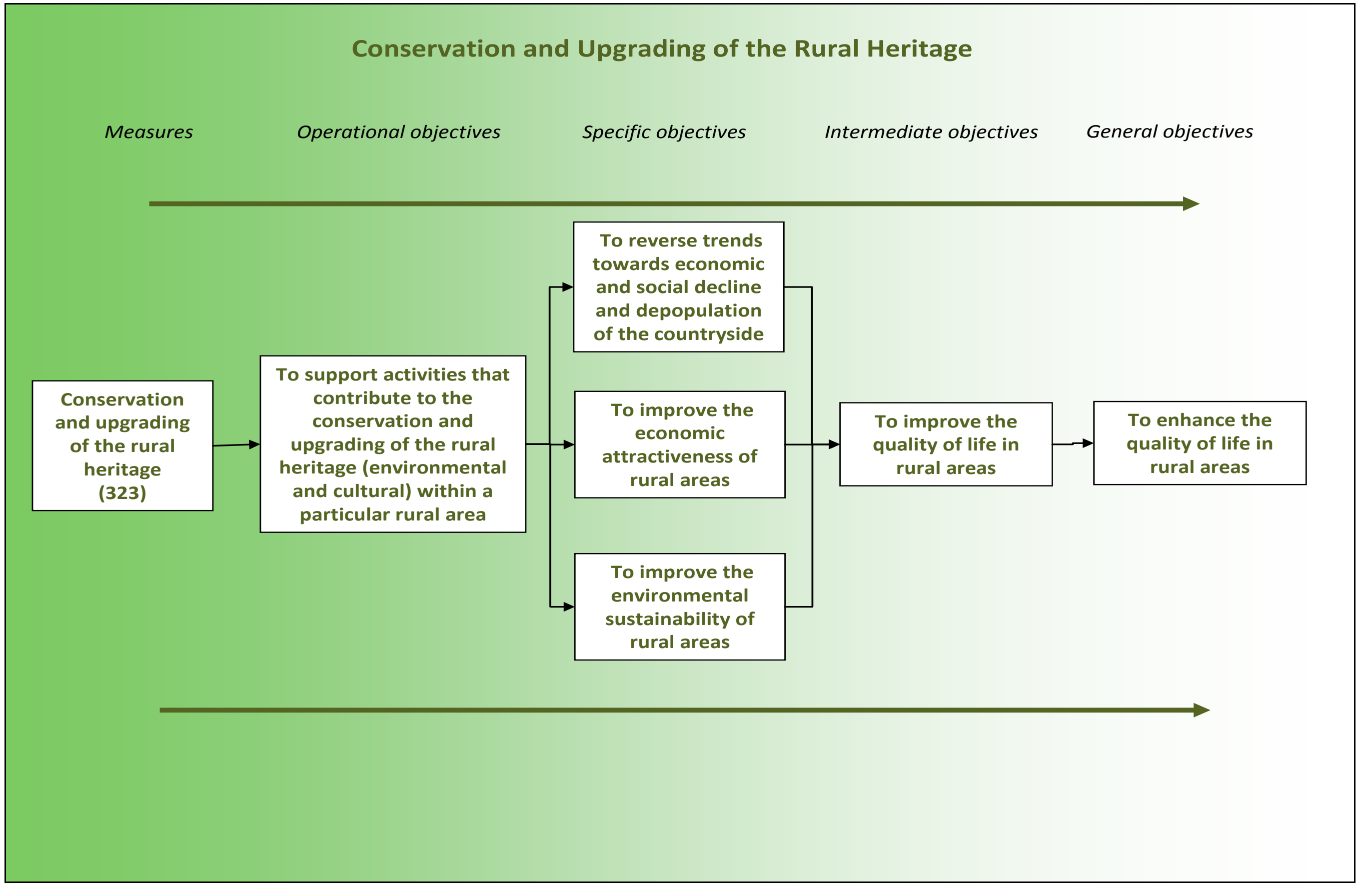
Annex Figure 19 Intervention Logic for Agri-Environment payments (214)

Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.



Annex Figure 20 Intervention Logic for diversification into non-agricultural activities (311)

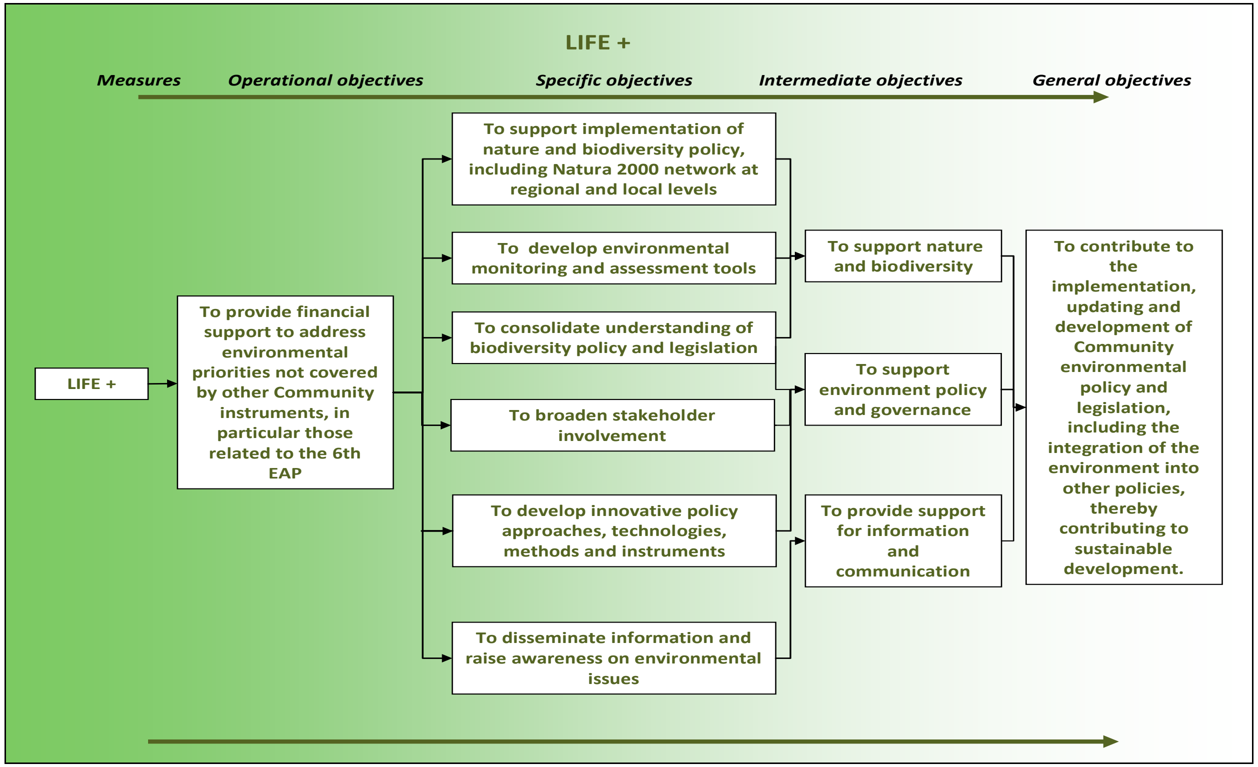
Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.



Annex Figure 21 Intervention Logic for conservation and upgrading of the rural heritage (323)

Source: 1) Rural Development policy 2007-2013 Common monitoring and evaluation framework (CMEF) – Guidance note E – Measure Fiches; 2) Council Regulation (EC) No 1698/2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD), 20 September 2005; 3) Council Decision 2006/144/EC on Community Strategic Guidelines for rural development programming period 2007-2013; 4) SEC (2005) 914 Annex to the Proposal for a Council Decision on Community Strategic Guidelines for Rural Development: Update to Impact Assessment Report SEC (2004) 931, Commission Staff Working Document.

LIFE + Programme



Annex Figure 22 Intervention Logic for the LIFE + Programme

Source: Regulation (EC) No 614/2007 of the European Parliament and of the Council of 23 May 2007 concerning the Financial Instrument for the Environment (LIFE+) - Commission statement, OJ L 149, 9.6.2007

ANNEX IX THE USE OF RURAL DEVELOPMENT MEASURES TO SUPPORT THE PROVISION OF PUBLIC GOODS

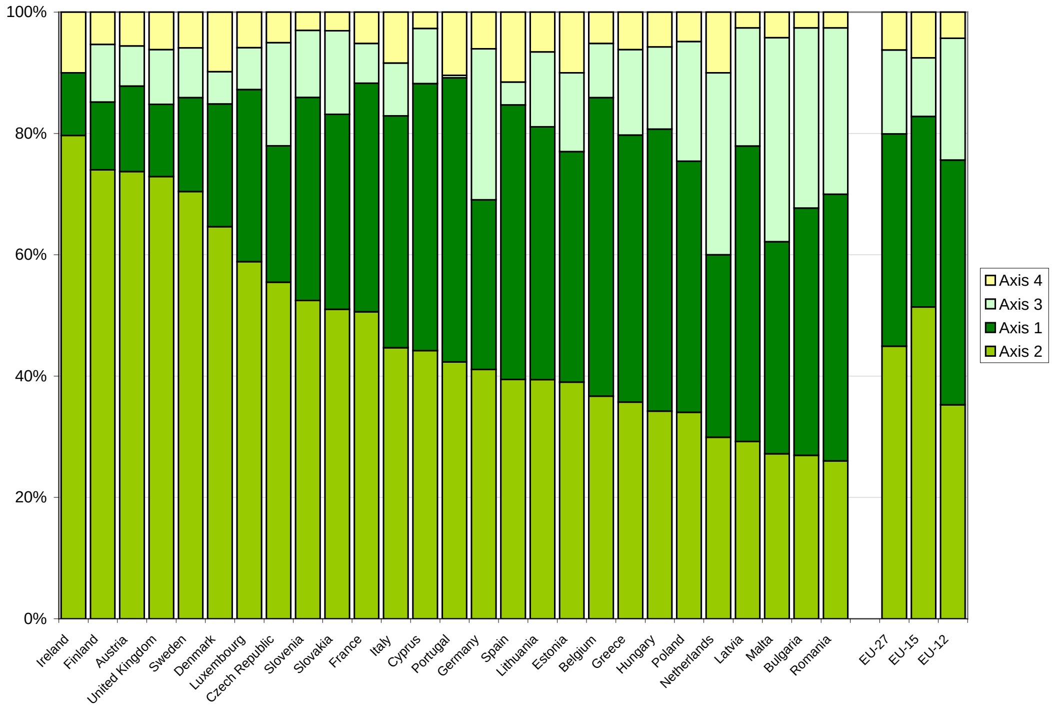
By far the largest proportion of funding for those agricultural management activities that provide public goods in the EU-27 Member States comes from the EAFRD. These measures can be divided into three groups:

- Those with a direct focus on the provision of public goods, for example:
  - Agri-environment payments (214)
- Those with a partial focus on the provision of public goods, for example:
  - Training and advice (111, 114, 115)
  - Farm modernisation (121)
  - Infrastructure development (125)
  - Natural handicap payments (211, 212)
  - Natura 2000 (213)
  - Conserving and upgrading the natural heritage
- Those with the potential to provide indirect support for the provision of public goods, for example:
  - Farm diversification (311)
  - Encouragement of tourism activities (313)

The environmental focus and therefore impact of rural development programmes varies significantly between Member States. At a generic level, this can be highlighted through an examination of the difference in the breakdown of EAFRD expenditure between Axes in the EU-27 (see Annex Figure 23). The proportion of the programme budget allocated to Axis 2 'improving the environment and the countryside' provides an initial, top level indication of the relative priority given to environmental objectives within each Member State, although it will also reflect other factors, such as the extent of LFA in the country.

While this can give us a broad indication of the environmental focus of the RDPs across Member States, it does not tell us about the actual environmental impact or effectiveness of the expenditure on the ground. To do this, more detailed information is needed on which particular measures are used within Axis 2 (and the wider RDP), the funding they receive, how related schemes are designed and implemented in each Member State or region, and the level of scheme uptake.

In the EU-27, it can be seen that Axis 2 accounts for approximately 45 per cent of expenditure under Pillar Two for the 2007-13 programming period (excluding national co-financing), of which the agri-environment and the two natural handicap measures make up over 80 per cent. This average figure, however, masks a significant variation between Member States. Four Member States (Finland, Ireland, Austria and the UK) stand out in particular, allocating over 70 per cent of their total budget to Axis 2. There is, however, a rather larger group of twelve Member States, which have all allocated less than 40 per cent of their budget to Axis 2, a mixture of new Member States and old, primarily Mediterranean Member States.



Annex Figure 23 **Distribution of 2007-13 EAFRD planned expenditure by Member State**

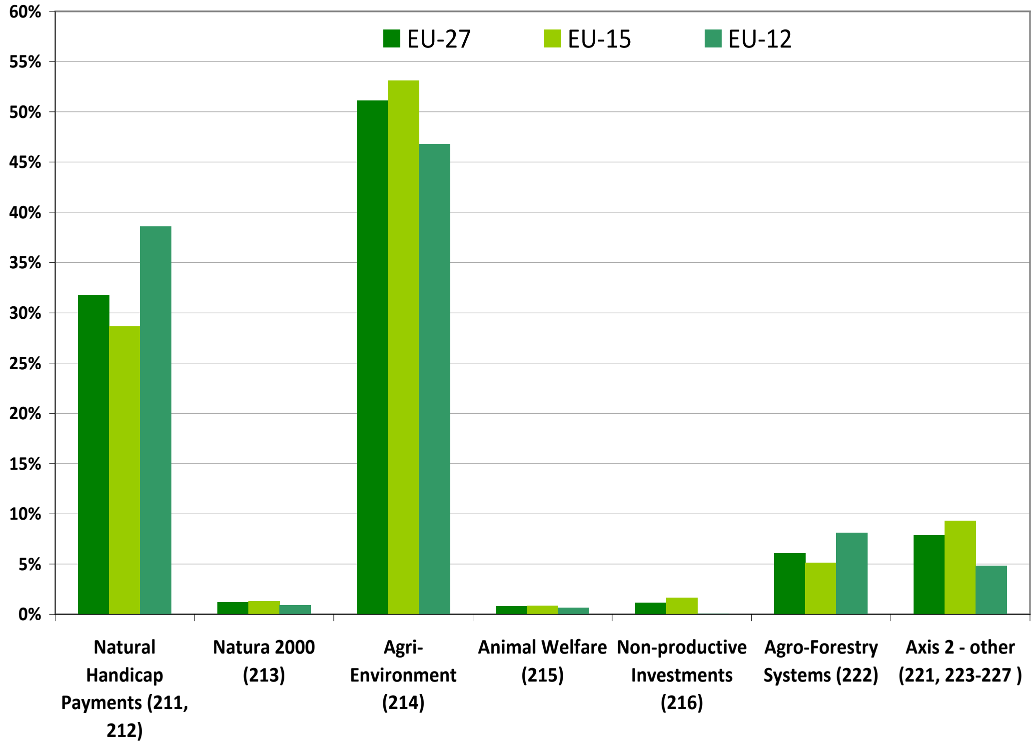
Source: IEEP calculations based on programmed expenditure within individual RDPs for 2007-13.

Given the range of EAFRD measures that have the potential to support the provision of public goods, set out above, an initial overview of the most significant EAFRD measures is provided, with particular emphasis given to those that account for the greatest planned programme expenditure in the 2007-13 programming period.

Measures to support land management practices that deliver public goods

Axis 2 of EAFRD includes two specific measures that are directly focused on the provision of public goods associated with agriculture – the agri-environment measure and the non-productive investments measure. It also includes the natural handicap (LFA) measures which, although not directly targeted at the delivery of environmental benefits, do often have a positive impact on public good provision in practice, and the Natura 2000 measure, which provides payments to help farmers address specific disadvantages within Natura 2000 areas as a result of requirements emanating from the Birds and Habitats Directives (79/409/EEC and 92/43/EEC).

There are a total of 88 RDPs in the EU-27 and each includes different combinations of Axis 2 measures and allocates differing proportions of funding to these measures to reflect national and regional needs. Annex Figure 24 shows the breakdown of planned expenditure for the 2007-13 programming period between the Axis 2 measures for all EU-27 Member States. Figures for those Member States where regional programmes exist (Belgium, Germany, Italy, Spain, UK) have been combined.



Annex Figure 24 **Distribution of Axis 2 EAFRD planned expenditure within 2007-13 RDPs in the EU-27**

Source: IEEP calculations based on programmed expenditure within individual RDPs for 2007-13.

Within Axis 2, the most significant measure, both in terms of its budgetary allocation and in terms of the benefits it can deliver for public goods, is the agri-environment measure, which aims to 'encourage land managers and other land managers to serve society as a whole by introducing or continuing to apply production methods compatible with the protection and improvement of the environment, the landscape and its features, natural resources, the soil and genetic diversity'[29].

This measure, which is the only compulsory measure for all Member States to implement, accounts for approximately half of all EAFRD planned expenditure allocated to Axis 2 in the EU-27 and ranges from 82 per cent in Belgium to 25 per cent in Portugal.

[29] Council Regulation 1698/2005, preamble, paragraph 31.

The two natural handicap payment measures - collectively referred to as the LFA measures - aim to maintain the countryside and promote sustainable farming systems through the continued use of agricultural land. These measures typically help to maintain extensive livestock based systems which, if appropriately managed, are crucial to the maintenance of species rich semi-natural pastures.

Together these two measures account for approximately one third of the planned Axis 2 EAFRD budget across the EU-27 (14 per cent is allocated to the measure to provide natural handicap payments to farmers in mountain areas and 16 per cent to farmers in other areas with handicaps). The proportion of the Axis 2 budget allocated to the LFA measure varies significantly across Member States, from under five per cent of the budget in Hungary and Denmark to over 50 per cent in Finland, Malta and Slovakia. A low level of expenditure is likely to be indicative either of a small proportion of the land designated as LFA, or reflects the eligibility criteria that restrict the number of beneficiaries who are eligible for the aid.

The Natura 2000 measure relating to agricultural land provides income support to farmers to compensate for meeting the legal requirements set out under the Birds and Habitats Directives on these sites. Only 14 Member States have used this Natura 2000 measure, and overall it accounts for less than one per cent of the total EAFRD budget allocated to Axis 2 over the current programming period. One reason for this is that the choice of how Natura 2000 obligations are met is left to Member States While some of these may be required through the imposition of mandatory standards, others are achieved through the provision of support for actions that go beyond mandatory standards and this support is often provided through the agri-environment measure as an alternative to the Natura 2000 measure.

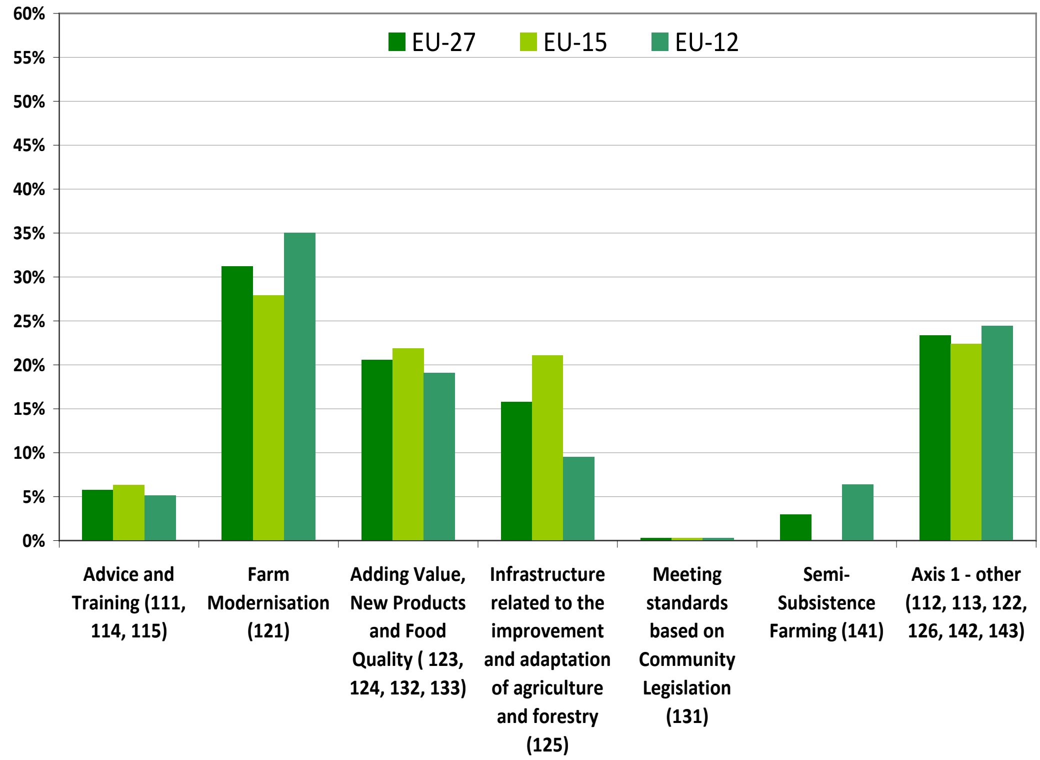
Measures to support investments that can underpin the provision of environmental public goods

Both Axis 1 and Axis 3 of the EAFRD contain measures which have the potential to be used to support investments which can improve the provision of environmental public goods through reducing the environmental impact of certain farming activities.

Such investment might be associated with improvements in farm infrastructure, such as improving housing for livestock, improving slurry storage facilities which would help improve water quality, or introducing anaerobic digesters, leading to a reduction in GHG emissions (for example, by using measure 121, the farm modernisation measure), or investments beyond the farm holding including those for:

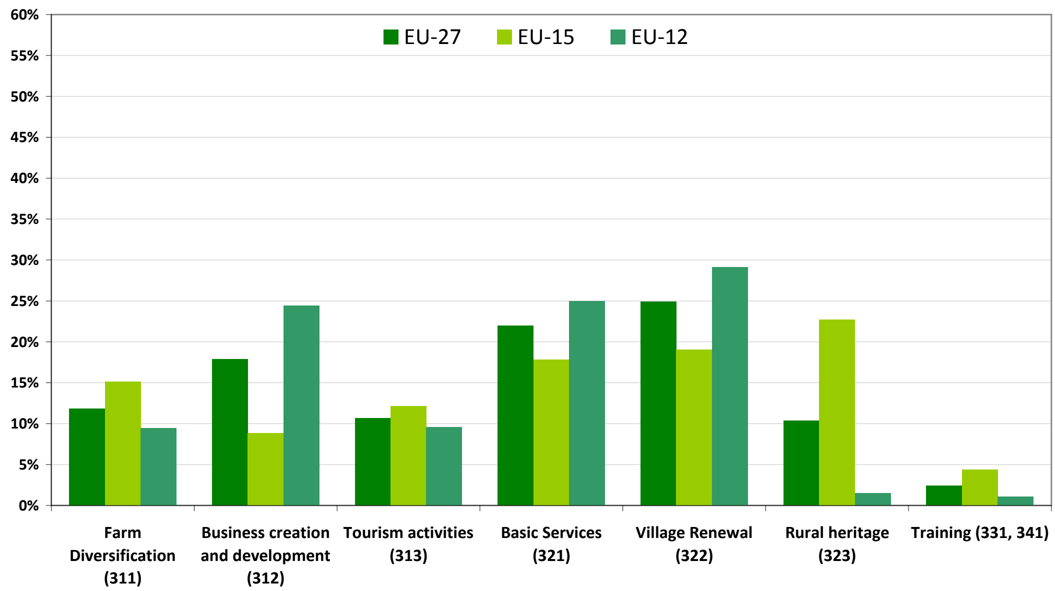
- Improving the efficiency of processing quality products (for example using measure 123 on adding value to agricultural products), which are of particular value in HNV farming systems; or
- Providing local services, such as mobile abattoirs to help support local farmers producing quality local meat (for example using measure 321 on basic services for the economy and rural population); or
- Maintaining, restoring and upgrading the cultural heritage, including support for the production of management plans for Natura 2000 sites (for example, using measure 323 on the conservation and upgrading of the rural heritage).

Member States use these Axis 1 and Axis 3 measures in different ways, some of which are set out in Chapter 5, and it should be noted that certain of these measures may also be used to support actions at the farm level that do not deliver public goods and that they may cause environmental degradation unless appropriate conditions and safeguards are enforced effectively. Annex Figure 25 shows the breakdown of planned expenditure for the 2007-13 programming period between all Axis 1 measures for all EU-27 Member States and Annex Figure 26 shows the breakdown for all Axis 3 measures for the EU-27, EU-15 and EU-12 grouped together. Figures for those Member States where regional programmes exist (Belgium, Germany, Italy, Spain, UK) have been combined. It is not possible to determine the proportion of the EAFRD budget that is focused on the delivery of environmental public goods for these measures, as this will depend on the way in which individual measures are implemented by each Member State. However, it does show that, a significant proportion of the Axis 1 budget is allocated to the farm modernisation measure, the added value and food quality measures and the infrastructure development measures, all of which do have the potential to improve the delivery of environmental public goods.



Annex Figure 25 **Distribution of Axis 1 EAFRD planned expenditure within 2007-13 Rural Development Programmes in the EU-27**

Source: IEEP calculations based on programmed expenditure within individual RDPs for 2007-13.



Annex Figure 26 **Distribution of planned Axis 3 EAFRD expenditure within 2007-13 Rural Development Programmes in the EU-27**

Source: IEEP calculations based on programmed expenditure within individual RDPs for 2007-13.

Measures to support improvements in the skills and environmental capacity of farmers

Measures to support improvements in the skills and environmental capacity of farmers include the advisory and training measures that sit within Axis 1. Although these measures account for less than two per cent of the total EAFRD budget, they have the potential, along with the training measures within Axis 3, to contribute significantly to the provision of public goods. For example, support for advice and training on precision farming methods, efficient use of fertilisers, or climate mitigation measures will all help to improve the capacity of farmers and improve their understanding of how to address the environmental challenges associated with water quality, soil functionality and carbon storage etc. In addition, the Axis 3 training measure for rural actors (measure 331) can be used to provide agricultural contractors with skills in traditional management practices such as hedge laying or dry stone walling, and to provide training for other rural actors in skills in traditional crafts or construction that use agricultural products (for example thatching, basket weaving, traditional building etc).

ANNEX X GAEC STANDARDS IMPLEMENTED AT THE NATIONAL/ REGIONAL LEVEL

Annex Table 38 provides an overview of those GAEC Standards that have been introduced as part of cross compliance within selected Member States and which require actions beyond those specified in national or regional legislative requirements for each of the ten environmental public goods that form the focus of this study. These standards, therefore, form part of the sanctioning mechanisms for those who wish to receive full CAP payments under the scope of cross compliance (decoupled direct payments and certain wine payments) and forms the baseline for area related rural development payments.

The table is based on information provided by the case study experts. It is accurate to the best of our knowledge but is not comprehensive and does not include any new GAEC standards that have been proposed as a result of new obligations under Council Regulation 73/2009. Details are provided for the eight case study Member States, where information has been supplied.

Annex Table 38 GAEC standards implemented at the national/regional level, displayed by public good

Agricultural Landscapes	
CZ	Landscape features, including ridges, terraces, windbreaks, grassed *talwegs*, field roads (possibly with ditches) following natural contours, watercourses and water bodies must not be damaged or removed. Conversion of grassland to arable prohibited.
DE	On fallow land green cover must be maintained, and cut (but not between 1 April and 15 July) Grasslands mown annually (or biennially if cuttings removed)
ES	Removal of field boundaries or landscape structures requires prior authorisation. Tree removal without replacement must be notified to relevant authority. On slopes >15% no grubbing up of permanent crops. Olive trees to be appropriately maintained and not removed. Maintain permanent pasture with minimum grazing rate of 0.1 LU/ha (or regionally authorised min/ max), or by other means.
FR	Environmental buffer strips at least 5m wide must be sown on 3% of the farm's UAA (using defined plant species), with no fertilisers or pesticides. Cutting prohibited for 40 consecutive days 1 May to 15 July. Priority given to strips along rivers and water courses, then to footpaths, hedgerows, slopes and other areas.
IT	Terraces must be maintained (modifications to the shape are allowed to make mechanisation easier or for economic reasons). Olive trees may not be cut down, and must be maintained in good vegetative condition, with regular pruning. Replanting requires authorisation. Permanent pasture must be appropriately managed; no conversion to other uses or natural revegetation.
RO	Hedges, rows of trees and small woods must not be removed without authorisation. Terraces present in 2007 must be maintained. On fallow land green cover must be maintained, and cut. Unused permanent pastures must be mown every 2 years. Unwanted vegetation may not be permitted to invade agricultural land.
SE	On fallow land green cover must be maintained, without pesticides, herbicides or fertilisers, and with no cultivation until summer.

	Permanent pasture, meadows and arable land must be managed to avoid scrub and forest encroachment. Traditional hay meadows must be mown and harvested annually, and pastures mown or grazed.
UK (England)	No cultivation, fertilisers or pesticides within 2m of the centre of a hedgerow, watercourse or field ditch, or within 1m of the top of the bank of a watercourse or field ditch. On land not used for production maintain a green cover (by sowing or natural regeneration). No fertilisers, manure or slurry to be applied. On the whole area, cut scrub and cut or graze rank vegetation at least once every 5 years (no more than 50% of the area to be cut in each of the fourth and fifth years. Stone walls (and stone from walls) must not be removed. No overgrazing by or unsuitable supplementary feeding of livestock on natural or semi-natural vegetation.
Farmland Biodiversity	
CZ	Conversion of grassland to arable prohibited. Landscape features, including ridges, terraces, windbreaks, grassed *talwegs*, field roads (possibly with ditches) following natural contours, watercourses and water bodies must not be damaged or removed.
DE	At least 3 crops to be grown in the arable rotation, each on at least 15% of the area. Maintain humus levels in arable soils above threshold level. Grasslands mown annually (or biennially if cuttings removed).
ES	Fallow land to be managed by traditional cropping or minimum tillage or with an adequate vegetation cover (spontaneous or sown). Only low-risk, non-residual herbicides allowed. On unused fallow tillage must be used instead of herbicides. No more than 20 t/ha of dung or 40m3/ha of slurry is allowed on fallow in a three year period, and only on land with (or about to have) vegetative cover. Maintain permanent pasture by minimum grazing 0.1 LU/ha or by other means. Tree removal without replacement must be notified to relevant authority. Removal of field boundaries or landscape structures requires prior authorisation. Where herbicides are used around olive trees, maintain vegetative cover on ground between tree rows. Olive trees to be appropriately maintained and not removed. Observe requirements for disposal of olive prunings.
FR	Environmental buffer strips at least 5m wide must be sown on 3% of the farm's UAA (using defined plant species), with no fertilisers or pesticides. Cutting prohibited for 40 consecutive days 1 May to 15 July. Priority given to strips along rivers and water courses, then to footpaths, hedgerows, slopes and other areas.
IT	Permanent pasture must be appropriately managed; no conversion to other uses or natural revegetation.

	Olive trees may not be cut down, and must be maintained in good vegetative condition, with regular pruning. Replanting requires authorisation.
RO	Crop rotations must have a minimum of 3 crops, or 2 crops from different groups. Over winter at least 20% of arable land must be in winter crop or retained stubble. On fallow land green cover must be maintained, and cut. Burning of crop residues and permanent grasslands not permitted without authorisation. Unused permanent pastures must be mown every 2 years. Hedges, rows of trees and small woods must not be removed without authorisation.
SE	Permanent pasture, meadows and arable land must be managed to avoid scrub and forest encroachment. Traditional hay meadows must be mown and harvested annually, and pastures mown or grazed.
UK (England)	No cultivation, fertilisers or pesticides within 2m of the centre of a hedgerow, watercourse or field ditch, or within 1m of the top of the bank of a watercourse or field ditch. No overgrazing by, or unsuitable supplementary feeding of, livestock on natural or semi-natural vegetation. On land not used for production maintain a green cover (by sowing or natural regeneration). No fertilisers, manure or slurry to be applied. On the whole area, cut scrub and cut or graze rank vegetation at least once every 5 years (no more than 50% of the area to be cut in each of the fourth and fifth years). Hedgerows must not be cut or trimmed between 1 March and 31 July. Control of (defined) invasive weeds is obligatory. (Note: this is additional to requirement in national legislation to control injurious weeds).
Water Quality	
CZ	On slopes of >3 degrees, liquid farmyard manure incorporated within 24 hours of application. Landscape features, including ridges, terraces, windbreaks, grassed talwegs, field roads (possibly with ditches) following natural contours, watercourses and water bodies must not be damaged or removed.
DE	Over winter at least 40% of arable land must be unploughed or sown to new crop. No removal of terraces.
ES	On slopes >15% no ‘normal’ tillage or grubbing up of permanent crops. On slopes >10% no ploughing up and down slope. No ploughing in summer. In areas of high erosion risk, observe additional restrictions. No mechanical operations on waterlogged soil without authorisation.

	Fallow land must be managed by traditional cropping or minimum tillage or with an adequate vegetation cover (spontaneous or sown). Only low-risk, non-residual herbicides allowed. On unused fallow tillage must be used instead of herbicides. No more than 20 t/ha of dung or 40m^3/ha of slurry is allowed on fallow in a three year period, and only on land with (or about to have) vegetative cover. Maintain terraces and their drainage in working order, without levelling. No herbicides, fertilisers or dung applied to wetlands.
FR	Environmental buffer strips at least 5m wide must be sown on 3% of the farm's UAA (using defined plant species), with no fertilisers or pesticides. Cutting prohibited for 40 consecutive days 1 May to 15 July. Priority is given to strips along rivers and water courses, then to footpaths, hedgerows, slopes and other areas. Where there is no crop rotation (as above) there must be winter cover crops or stubble management on all the cropped area.
IT	Post harvest management practices required until 1 Feb. After sowing, create cross-slope drainage grips to take rainwater into drains on edge of the plot. If rill erosion is visible, grips must be ≤ 80 m apart (exemptions for steep slopes, permanent grass and continuous crop cover). Terraces must be maintained (modifications to the shape are allowed to make mechanisation easier or for economic reasons).
RO	On arable land with a slope >12%, row crops are prohibited, winter cover is required, and mechanical operations must be carried out along the contour. Over winter at least 20% of arable land must be in winter crop or retained stubble. On fallow land green cover must be maintained, and cut. Burning of crop residues and permanent grasslands not permitted without authorisation.
SE	No information provided
UK (England)	Post-harvest management is required (after combinable crops) until 1 March, using retained stubble or cover crops or a rough surface or another crop sown within 10 days of final seedbed preparation (cultivation to create stale seedbeds is allowed). No cultivation, fertilisers or pesticides within 2m of the centre of a hedgerow, watercourse or field ditch, or within 1m of the top of the bank of a watercourse or field ditch.
Water Availability	
CZ	
DE	
ES	

FR	The farmer must have an authorisation to pump water and must install an appropriate system to estimate pumped water volumes.
IT	
RO	
SE	
UK (England)	
Soil Functionality	
CZ	Prohibition on growing row crops on slopes >12 degrees. Landscape features, including ridges, terraces, windbreaks, grassed *talwegs,* field roads (possibly with ditches) following natural contours, watercourses and water bodies must not be damaged or removed. Conversion of grassland to arable prohibited. No stubble burning.
DE	Over winter at least 40% of arable land must be unploughed or sown to new crop (derogation allowed in areas where erosion risk is low). At least 3 crops to be grown in the arable rotation, each on at least 15% of the area. Maintain humus levels in arable soils above threshold level. Terraces must not be removed (without prior authorisation, where there is no erosion risk).
ES	On slopes >15% no 'normal' tillage or grubbing up of permanent crops. On slopes >10% no ploughing up and down slope. No ploughing in summer. Where herbicides are used around olive trees, maintain vegetative cover on ground between tree rows. Fallow land to be managed by traditional cropping or minimum tillage or with an adequate vegetation cover (spontaneous or sown). Only low-risk, non-residual herbicides allowed. On unused fallow tillage must be used instead of herbicides. No more than 20 t/ha of dung or 40m3/ha of slurry is allowed on fallow in a three year period, and only on land with (or about to have) vegetative cover. In areas of high erosion risk, observe additional restrictions on cropping. No mechanical operations on waterlogged soil (except rice paddies) without authorisation (and then observe rules for rutted areas). No removal of olive trees. Observe requirements for disposal of olive prunings.

	No stubble burning and no burning of permanent pastures without authorisation.
FR	Where there is a crop rotation it must either include: three different crops (each on at least 5% of the cropped area); or two different crops, if one is temporary pasture or an N-fixing crop on at least 10% of the cropped area (the other must cover at least 3% of the cropped area). Where there is no crop rotation (as above) there must be winter cover crops or stubble management on all the cropped area. No burning of crop residues.
IT	Cereals must not be grown continuously for more than 5 years. After sowing, create cross-slope drainage grips to take rainwater into drains on edge of the plot. If rill erosion is visible, grips must be ≤ 80 m apart (exemptions for steep slopes, permanent grass and continuous crop cover). Maintain an efficient water drainage system, cleaning channels, outfalls, ditches and drains by removing natural vegetation, and sediment. *Baulatura* (traditional convex shaping of land) must be maintained. Permanent pasture must be appropriately managed; no conversion to other uses or natural revegetation. Terraces must be maintained (modifications to the shape are allowed to make mechanisation easier or for economic reasons). Land not used for production must have green cover (natural or sown) throughout the year, and be mown at least once a year (but not during a 120-day between 15 March and 15 September (15 February and 30 September in Natura 2000 sites). During these periods, farmers must make "firebreak strips", by cutting grass or by ploughing. No burning of crop residues.
RO	On arable land with a slope >12%, row crops are prohibited, winter cover is required, and mechanical operations must be carried out along the contour. Over winter at least 20% of arable land must be in winter crop or retained stubble. Crop rotations must have a minimum of 3 crops, or 2 crops from different groups. On fallow land green cover must be maintained, and cut. Sunflowers may not be grown on the same land for more than 2 consecutive years. Terraces present in 2007 must be maintained. Maintain permanent pasture by minimum grazing density or at least annual mowing. Hedges, rows of trees and small woods must not be removed without authorisation. Burning of crop residues and permanent grasslands not permitted without authorisation.
SE	On fallow land green cover must be maintained, without pesticides, herbicides or fertilisers, and with no cultivation until summer. Permanent pasture, meadows and arable land must be managed to avoid scrub and forest encroachment. Traditional hay meadows must be mown and harvested annually, and pastures mown or grazed.

	No burning of crop residues.
UK (England)	Following published guidance, undertake and implement a Soil Protection Review (SPR), updating it at least once per year (or sooner if measures are not working). No mechanical field operations or motor vehicles allowed on waterlogged soil (exceptions for some essential work). Post-harvest management is required (after combinable crops) until 1 March, using retained stubble or cover crops or a rough surface or another crop sown within 10 days of final seedbed preparation (cultivation to create stale seedbeds is allowed. On land not used for production maintain a green cover (by sowing or natural regeneration). No fertilisers, manure or slurry to be applied. On the whole area, cut scrub and cut or graze rank vegetation at least once every 5 years (no more than 50% of the area to be cut in each of the fourth and fifth years. No overgrazing by, or unsuitable supplementary feeding of, livestock on natural or semi-natural vegetation.
Climate Stability - Carbon Storage	
CZ	Conversion of grassland to arable prohibited. No stubble burning.
DE	Over winter at least 40% of arable land must be unploughed or sown to new crop. Maintain humus levels in arable soils above threshold level. No stubble burning.
ES	Fallow land to be managed by traditional cropping or minimum tillage or with an adequate vegetation cover (spontaneous or sown). No ploughing in summer. On slopes >15% no grubbing up of permanent crops. No stubble burning and no burning of permanent pastures without authorisation. Olive trees to be appropriately maintained and not removed. Where herbicides are used around olive trees, maintain vegetative cover on ground between tree rows. Observe requirements on disposal of olive prunings.
FR	Environmental buffer strips at least 5m wide must be sown on 3% of the farm's UAA (using defined plant species), with no fertilisers or pesticides. Cutting prohibited for 40 consecutive days 1 May to 15 July. Priority given to strips along rivers and water courses, then to footpaths, hedgerows, slopes and other areas. No burning of crop residues.

IT	Land not used for production must have green cover (natural or sown) throughout the year, and be mown at least once a year (but not during a 120-day between 15 March and 15 September (15 February and 30 September in Natura 2000 sites). During these periods, farmers must make "firebreak strips", by cutting grass or by ploughing. Olive trees may not be cut down, and must be maintained in good vegetative condition, with regular pruning. Replanting requires authorisation. Permanent pasture must be appropriately managed; no conversion to other uses or natural revegetation. No burning of crop residues.
RO	Over winter at least 20% of arable land must be in winter crop or retained stubble. Burning of crop residues and permanent grasslands not permitted without authorisation. On fallow land green cover must be maintained, and cut. Maintain permanent pasture by minimum grazing density or at least annual mowing. Hedges, rows of trees and small woods must not be removed without authorisation. Crop rotations must have a minimum of 3 crops, or 2 crops from different groups.
SE	No burning of crop residues. On fallow land green cover must be maintained, without pesticides, herbicides or fertilisers, and with no cultivation until summer.
UK (England)	No cultivation, fertilisers or pesticides within 2m of the centre of a hedgerow, watercourse or field ditch, or within 1m of the top of the bank of a watercourse or field ditch. Post-harvest management is required (after combinable crops) until 1 March, using: retained stubble, cover crop, rough surface or another crop sown within 10 days of final seedbed preparation (cultivation to create stale seedbeds is allowed). On land not used for production maintain a green cover (by sowing or natural regeneration). No fertilisers, manure or slurry to be applied. On the whole area, cut scrub and cut or graze rank vegetation at least once every 5 years (no more than 50% of the area to be cut in each of the fourth and fifth years).
Climate Stability – GHG Emissions	
CZ	On slopes of >3 degrees, liquid farmyard manure incorporated within 24 hours of application. No stubble burning. Conversion of grassland to arable prohibited.
DE	Over winter at least 40% of arable land must be unploughed or sown to new crop. No stubble burning.

	Maintain humus levels in arable soils above threshold level.
ES	No ploughing in summer. Where herbicides are used around olive trees, maintain vegetative cover on ground between tree rows. On slopes >15% no grubbing up of permanent crops. Fallow land to be managed by traditional cropping or minimum tillage or with an adequate vegetation cover (spontaneous or sown). Only low-risk, non-residual herbicides allowed. On unused fallow tillage must be used instead of herbicides. No more than 20 t/ha of dung or 40m3/ha of slurry is allowed on fallow in a three year period, and only on land with (or about to have) vegetative cover. No stubble burning and no burning of permanent pastures without authorisation. No mechanical operations on waterlogged soil (except rice paddies) without authorisation (and then observe rules for rutted areas).
FR	No burning of crop residues.
IT	No burning of crop residues. Permanent pasture must be appropriately managed; no conversion to other uses or natural revegetation. Olive trees may not be cut down, and must be maintained in good vegetative condition, with regular pruning. Replanting requires authorisation. Land not used for production must have green cover (natural or sown) throughout the year, and be mown at least once a year (but not during a 120-day between 15 March and 15 September (15 February and 30 September in Natura 2000 sites). During these periods, farmers must make "firebreak strips", by cutting grass or by ploughing.
RO	Over winter at least 20% of arable land must be in winter crop or retained stubble. Burning of crop residues and permanent grasslands not permitted without authorisation.
SE	No burning of crop residues.
UK (England)	Post-harvest management is required (after combinable crops) until 1 March, using: retained stubble, cover crop, rough surface or another crop sown within 10 days of final seedbed preparation (cultivation to create stale seedbeds is allowed).
Air Quality	
CZ	On slopes of >3 degrees, liquid farmyard manure incorporated within 24 hours of application. No stubble burning.
DE	Over winter at least 40% of arable land must be unploughed or sown to new crop.

	No stubble burning.
ES	No ploughing in summer. On slopes >15% no grubbing up of permanent crops. No stubble burning. No burning of permanent pastures without authorisation.
FR	
IT	No burning of crop residues.
RO	Burning of crop residues and permanent grasslands not permitted without authorisation.
SE	No burning of crop residues.
UK (England)	
Resilience to Flooding	
CZ	Prohibition on growing row crops on slopes >12 degrees. Conversion of grassland to arable prohibited.
DE	Over winter at least 40% of arable land must be unploughed or sown to new crop. No removal of terraces.
ES	On slopes >15% no 'normal' tillage or grubbing up of permanent crops. On slopes >10% no ploughing up and down slope. No mechanical operations on waterlogged soil (except rice paddies) without authorisation (and then observe rules for rutted areas).
FR	
IT	Terraces must be maintained (modifications to the shape are allowed to make mechanisation easier or for economic reasons).
RO	Mechanical operations must be carried out along the contour on arable land with a slope >12%. Terraces present in 2007 must be maintained.
SE	

UK (England)	
Resilience to Fire	
CZ	Prevent encroachment of scrub on agricultural land No stubble burning.
DE	Grasslands mown annually (or biennially if cuttings removed). No stubble burning.
ES	Maintain permanent pasture by minimum grazing 0.1 LU/ha, or by other means. Remove unwanted vegetation where this threatens crop or habitat. No stubble burning and no burning of permanent pastures without authorisation. Observe requirements for disposal of olive prunings.
FR	Minimum level of management to limit weed and scrub growth.
IT	Land not used for production must have green cover (natural or sown) throughout the year, and be mown at least once a year (but not during a 120-day between 15 March and 15 September (15 February and 30 September in Natura 2000 sites). During these periods, farmers must make "firebreak strips", by cutting grass or by ploughing. No burning of crop residues.
RO	Unused permanent pastures must be mown every 2 years. Burning of crop residues and permanent grasslands not permitted without authorisation.
SE	Permanent pasture, meadows and arable land must be managed to avoid scrub and forest encroachment. Traditional hay meadows must be mown and harvested annually, and pastures mown or grazed.
UK (England)	

ANNEX XI POLICY CHALLENGES AND THE EXISTING POLICY FRAMEWORK

The tables that follow serve to summarise information contained in Chapters 4 and 5 in the form of ten fiches. The fiches introduce the broad policy challenges that have been identified if the undersupply of environmental public goods provided through agriculture in the EU is to be addressed. They present existing EU policy targets, the relevant EU legislative baseline, and the policy measures that are used currently to address these challenges.

<table>
<tr><th colspan="2">Policy Challenge 1: To Maintain the Diversity and Distinctiveness of Agricultural Landscapes</th></tr>
<tr><td colspan="2">Traditional agricultural landscapes across the EU are highly valued for their aesthetic character and cultural associations - often resulting from a significant degree of continuity in the pattern of the main landscape elements - which in turn contributes to a sense of place, regional identity and cultural heritage. The character of many agricultural landscapes is being degraded due to a concentration and specialisation in agricultural production, intensification in land use, coupled with the removal of landscape elements, and agricultural abandonment.

There is a need to safeguard the diversity of agricultural landscapes at a European scale, and to maintain their integrity and distinctive character as a landscape scale - in terms of the mix of land uses, the continuity and structural diversity of habitats and farming systems and the presence of livestock, and of mosaics at a more micro-scale through the maintenance and restoration of landscape elements.

Extensive farming systems that include grazing (livestock, arable or mixed systems) and trees (for forage, shelter of as permanent crops) are particularly important for meeting this need. Key farming practices include maintaining a high proportion of the farm area as permanent semi-natural vegetation, land managed as small fields/plots, retaining traditional farm buildings and structures, drove roads and tracks, stone heaps, rock outcrops hedges, stone walls, earth banks, unfarmed strips, and lines of trees/bushes. These types of systems and farming practices will also provide additional benefits for farmland biodiversity, water quality, soil functionality, and carbon storage.</td></tr>
<tr><th colspan="2">Targets</th></tr>
<tr><td>EU Legislative Targets</td><td>• To set up a system of Environmental Impact Assessment for proposals likely to lead to the intensification of semi-natural and uncultivated land (Environmental Impact Assessment Directive 97/11/EC).</td></tr>
<tr><td>EU Strategies, Action Plans etc.</td><td>• To encourage the integration of landscape into all relevant policies – cultural, social and economic (Council of Europe, European Landscape Convention, Florence 2000).
• To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … biodiversity and the preservation and development of high nature value farming and forestry systems and traditional agricultural landscapes (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC).
• To maintain and enhance good ecological infrastructures, and</td></tr>
</table>

	promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final). • To conserve and appropriately restore areas of significant landscape values including cultivated as well as sensitive areas (Sixth Environmental Action Programme - 1600/2002/EC).
Legislative Baseline	
EU Directives/Regulation	Requirement to encourage the management of habitats and features of the landscape which are essential for the migration, dispersal and genetic exchange of wild species through: Habitats Directive (92/43/EEC) Birds Directive (79/409/EEC)
Current Policy Measures	
Direct Focus	CAP Pillar 2 - EAFRD: - Agri-Environment measure (214) - Non-Productive investments (216)
	LIFE + programme
	CAP Pillar 1: - Cross-Compliance: GAEC Standards for the retention of landscape features and avoiding the deterioration of habitats - Article 68 special support for i) specific types of farming which are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
	Selection of National Policy Measures - UK – Heritage Lottery Funded projects - AT – Compensation payments to farmers in tourist communities
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Natural Handicap Payments (211/212) - Natura 2000 Payments (213) - Upgrading rural heritage (323)
No Direct Focus	CAP Pillar 1: - Decoupled payments - Article 68 – support to address specific disadvantages in certain economically vulnerable or environmentally sensitive areas - Cross-compliance: GAEC standards for avoiding the encroachment of unwanted vegetation or minimum stocking rates CAP Pillar 2 - EAFRD - Adding value to agricultural products (123) - Supporting farmers who participate in food quality schemes (132) - Diversification (311)

Policy Challenge 2: To Maintain and Enhance the Ecological Integrity of Agricultural Areas	
The ecological integrity of many agricultural areas in the EU is under threat as a result of intensification, landscape simplification and fragmentation, resulting in the loss of habitat mosaics with negative impacts on the feeding, breeding, dispersal and migratory needs of farmland species. In turn, this contributes to the loss of biodiversity and of associated ecosystem services such as pollination. **There is a need to support the maintenance and beneficial management of habitats within more intensively managed cropland** – particularly semi-natural vegetation and grassland – in ways that promote species richness and biodiversity, **and to maintain and restore non-farmed landscape elements to maintain and enhance ecological integrity, resilience and functional connectivity at a landscape scale**. Particularly relevant farming practices for meeting this need include reducing inputs, retaining single trees/ small groups of trees, open channels with significant emergent and/or riparian vegetation, and retaining a high proportion of grass in farm area, including beetle banks in arable fields. These farming practices will also provide benefits for landscape, species adaptation to climate change, carbon sequestration, and soil functionality.	
Targets	
International Conventions	• To achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level by 2010 (Convention on Biological Diversity, 1992)
EU Legislative Targets	• To maintain the appropriate management of habitats within protected areas; to re-establish destroyed habitats and to create habitats (Birds Directive - 79/409/EEC).
EU Strategies, Action Plans etc.	• To halt the loss of biodiversity and contribute to a significant reduction in the worldwide rate of biodiversity loss by 2010 (EU Sustainable Development Strategy, Council Decision 10117/2006). • To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … biodiversity and the preservation and development of high nature value farming and forestry systems and traditional agricultural landscapes (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC). • To maintain and enhance good ecological infrastructures, and promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM (2001) 0162 final). • To conserve species and habitats, with special concern to prevent habitat fragmentation (Sixth European Environmental Action Plan 1600/2002/EC)
Legislative Baseline	
EU Directives/Regulation	Requirement to encourage the management of habitats and features of the landscape which are essential for the migration, dispersal and genetic exchange of wild species through: Habitats Directive (92/43/EEC) Birds Directive (79/409/EEC)

Current Policy Measures	
Direct Focus	CAP Pillar 2 - EAFRD: - Natura 2000 Payments (213) - Agri-Environment measure (214)
	LIFE + programme
	CAP Pillar 1: - Cross-Compliance: GAEC Standards for the retention of landscape features and avoiding the deterioration of habitats - Article 68 special support for i) specific types of farming which are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
	Selection of National Policy Measures - FR – LPO national biodiversity programme - DE – Payments by results pilot project in Northeim, Lower Saxony
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Natural Handicap Payments (211/212) - Upgrading rural heritage (323)
No Direct Focus	CAP Pillar 1: - Decoupled payments - Article 68 – support to address specific disadvantages in certain economically vulnerable or environmentally sensitive areas - Cross-compliance: GAEC standards for avoiding the encroachment of unwanted vegetation or minimum stocking rates CAP Pillar 2 - EAFRD - Adding value to agricultural products (123) - Supporting farmers who participate in food quality schemes (132) - Diversification (311) - Tourism activities (313)

Policy Challenge 3: To Conserve and Restore Farmland Biodiversity

In most of Europe, centuries of agricultural management has transformed the native, climax vegetation, resulting in significant changes in vegetation composition and structure. Many species have adapted to these changes and are now dependent on the continuation of predominantly traditional low intensity farming systems and associated management practices, some of which are analogues of former natural habitats that no longer exist in a European context (such as grassland steppes). However, these habitats - particularly those associated with High Nature Value farmland - and their associated species are under threat in much of Europe, primarily as a result of structural shifts in farming, investments and technological developments, resulting in either intensification or agricultural land abandonment (Baldock *et al*., 1993; Beaufoy *et al*., 1994; EEA, 2004).

As a result, declines in many farmland species - of both rare species and common species - have been recorded in recent decades, and these are particularly well documented with respect to farmland birds in Europe (Pain and Pienkowski, 1997; Tucker and Evans, 1997; Donald *et al*., 2001; Newton, 2004) showing that farmland bird populations are continuing to decline (EBCC/RSPB/BirdLife International/Statistics Netherlands (2008), cited in EEA (2009b)).

There is a need to halt further losses and to restore farmland biodiversity through the **maintenance of High Nature Value farming systems**, the reduction of damaging practices **and the adoption of beneficial farming practices in more intensive agricultural landscapes**.

Particularly beneficial farming practices include the continued active management of the land at low levels of intensity, for example pastures or wooded pastures at the appropriate grazing density, or maintaining extensive arable practices etc. Maintaining these sorts of farming practices will also have benefits for landscape, will reduce the risk of fire, as well as having socio-cultural benefits and help to maintain the vitality of rural areas.

Targets

International Conventions	• To achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level by 2010 (Convention on Biological Diversity, 1992).
EU Legislative Targets	• To maintain populations of a specified list of rare or threatened birds and migratory birds at certain levels through measures including the creation of protected areas; to maintain the appropriate management of habitats within protected areas; to re-establish destroyed habitats and to create habitats (Birds Directive - 79/409/EEC). • To protect all wild birds, including in general a prohibition on their killing and the destruction of their nests (Birds Directive - 79/409/EEC). • To prohibit the killing, disturbance and destruction of nests of certain animal species and of the picking of certain plants (Habitats Directive - 92/43/EEC).
EU Strategies, Action Plans etc.	• To halt the loss of biodiversity and contribute to a significant reduction in the worldwide rate of biodiversity loss by 2010 (EU Sustainable Development Strategy, Council Decision 10117/2006). • To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … biodiversity and the preservation and

	development of high nature value farming and forestry systems (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC). • To promote and support environmentally-friendly farming practices and systems that benefit biodiversity directly or indirectly (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final). • To support sustainable farming activities in biodiversity-rich areas (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final). • To maintain and enhance good ecological infrastructures, and promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM(2001) 0162 final). • To conserve species and habitats, with special concern to prevent habitat fragmentation (Sixth European Environmental Action Plan 1600/2002/EC) • To protect/restore nature and biodiversity from damaging pollution (Sixth European Environmental Action Plan 1600/2002/EC).
Legislative Baseline	
EU Directives/Regulation	Designation of protected sites and protection of listed species through: Habitats Directive (92/43/EEC) Birds Directive (79/409/EEC)
Current Policy Measures	
Direct Focus	CAP Pillar 2 - EAFRD: - Natura 2000 Payments (213) - Agri-Environment measure (214)
	LIFE + programme
	CAP Pillar 1: - Article 68 special support for i) specific types of farming which are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Natural Handicap Payments (211/212) - Upgrading rural heritage (323)
No Direct Focus	CAP Pillar 1: - Decoupled payments - Article 68 – support to address specific disadvantages in certain economically vulnerable or environmentally sensitive areas - Cross-compliance: GAEC standards for avoiding the encroachment of unwanted vegetation or minimum stocking rates
	CAP Pillar 2 - EAFRD - Adding value to agricultural products (123)

	- Supporting farmers who participate in food quality schemes (132) - Diversification (311) - Tourism activities (313) - Basic services (321) - Village renewal (322)

Policy Challenge 4: To Conserve Genetic Diversity	
There are over 2300 different breeds of livestock in Europe today, more than anywhere else in the world. They, as well as local crop varieties, have evolved through centuries of local farming traditions and are therefore particularly well adapted to their environment. An important component of halting biodiversity loss is to preserve the genetic diversity of crops and domesticated species. **There is a need to conserve the EU's rare domestic breeds and crop varieties**, to promote genetic diversity and to ensure the continuation of the characteristic grazing preferences of these livestock which in turn help to maintain the species diversity and structure of habitats of European importance. Local crops provide landscape and biological diversity and both crops and breeds form a gene pool which may be needed as European agriculture adapts to a changing climate and the new pests and diseases it is likely to bring. Particularly beneficial farming practices include growing locally adapted crop varieties and the use of local breeds of livestock adapted to the local climatic and vegetative conditions. This will also be beneficial for cultural landscapes.	
Targets	
International Conventions	• To achieve a significant reduction of the current rate of biodiversity loss at the global, regional and national level by 2010 (Convention on Biological Diversity, 1992).
EU Strategies, Action Plans etc.	• To halt the loss of biodiversity and contribute to a significant reduction in the worldwide rate of biodiversity loss by 2010 (EU Sustainable Development Strategy, Council Decision 10117/2006). • To promote and support environmentally-friendly farming practices and systems that benefit biodiversity directly or indirectly (EU Sectoral Biodiversity Action Plan for Agriculture COM (2001) 0162 final). • To promote actions to conserve local or threatened livestock breeds or plant varieties (EU Sectoral Biodiversity Action Plan for Agriculture COM (2001) 0162 final).
Legislative Baseline	
EU Directives/Regulation	None
Current Policy Measures	
No Direct Focus	CAP Pillar 2 - EAFRD: - Agri-Environment measure (214)
	CAP Pillar 1: - Article 68 special support for i) specific types of farming which

	are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
	LIFE + programme
	Selection of National Policy Measures - UK – Limestone Country project
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Natural Handicap Payments (211/212)
No Direct Focus	CAP Pillar 1: - Decoupled payments CAP Pillar 2 - EAFRD - Adding value to agricultural products (123) - Supporting farmers who participate in food quality schemes (132).

Policy Challenge 5: To Achieve Good Ecological Status in All Water Bodies	
High quality water is conducive to human and ecosystem health, and supports biodiversity. Given that many of Europe's watercourses and groundwater bodies are adversely affected by point and diffuse pollution as a result of nutrients and sediment from agricultural run-off, **there is a need to achieve good ecological status of all water bodies.** Particularly beneficial farming practices include retaining a high proportion of grass within the farm area, applying low levels of N and P fertilisers, low levels of pesticides, zero slurry production, nutrient management planning, minimising point source pollution from livestock housing, the use of cover crops, the use of fallow land within arable rotations, the reversion of arable to pasture. Many of these farming practices will also bring about benefits for soil functionality and biodiversity.	
Targets	
International Conventions	• To prevent and control pollution, sustainable use and conservation of transboundary watercourses and lakes (Helsinki Convention 1992).
EU Legislative Targets	• To enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands, promote the sustainable use of water and reduce water pollution (Water Framework Directive 2000/60/EC). • To achieve good ecological status of all water bodies by 2015 (Water Framework Directive 2000/60/EC). • To reduce the pollution of water caused or induced by the application and storage of inorganic fertiliser and manure on farmland and prevent further such pollution to safeguard drinking water supplies and to prevent wider ecological damage through the eutrophication of freshwater and marine waters. (Nitrates Directive 91/676/EC). • To prevent the discharge of certain toxic, persistent and bioaccumulable substances into groundwater (Groundwater Directive 80/68/EEC) • To protect the environment as a whole by preventing or minimising emissions to all media (air, land and water) (IPPC 96/61/EC) • To reduce risks and impacts of pesticide use on human health and the environment and encourage the development and introduction of integrated pest management and of alternative approaches or techniques in order to reduce dependency on the use of pesticides (Pesticides Framework Directive 2009/128/EC)
EU Strategies, Action Plans etc.	• To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … water…. (Community Strategic Guidelines for Rural Development, 2007 – 2013 2006/144/EC).
Legislative Baseline	
EU Directives/Regulation	Restrictions imposed on levels of inputs to land/water under the: • Nitrates Directive (91/676/EC) • Groundwater Directives (80/68/EEC and 2006/118)

	• Plant Protection Products Directive (91/414/EEC) • Sewage Sludge Directive (86/278/EEC) • Integrated pollution prevention and control (IPPC) Directive (2008/1/EC) NB: The Water Framework Directive (2000/60/EC) is not yet implemented at the farm level, but actions being developed to achieve the objectives for each river basin will overlap to a significant extent with those already in place for the Nitrates Directive
Current Policy Measures	
Direct Focus	CAP Pillar 2 - EAFRD: - Natura 2000 Payments (213) - Agri-Environment measure (214)
	CAP Pillar 1: - Cross-Compliance: GAEC Standards for the retention of landscape features; avoiding the deterioration of habitats; minimum soil cover; retention of terraces; appropriate machinery use; arable stubble management; standards for crop rotations; establishment of buffer strips along water courses - Article 68 special support for i) specific types of farming which are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
	Selection of National Policy Measures - UK – England Catchment Sensitive Farming Delivery Initiative (ECSFDI)
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Farm Modernisation measure (121) - Adapting to demanding standards (131)
	LIFE + programme
No Direct Focus	CAP Pillar 1: - Decoupled payments - Article 68 – support to address specific disadvantages in certain economically vulnerable or environmentally sensitive areas - Cross-compliance: GAEC standards for avoiding the encroachment of unwanted vegetation or minimum stocking rates.

<table>
<tr><th colspan="2">Policy Challenge 6: To Encourage Sustainable Water Use</th></tr>
<tr><td colspan="2">Around 50 per cent of the EU population currently live in water stressed areas, largely due to the increasingly unsustainable exploitation of water resources by abstraction, particularly for agricultural use, for example, for the irrigation of high value crops in the Mediterranean region. This is being exacerbated by climate change.

There is a need to ensure the sustainable use of surface and groundwater supplies by matching the water abstraction rate to the replenishment rate of water from rivers and groundwater aquifers, to ensure that the water saved is returned to the environment and to ensure the security of long-term supply for all users.

Beneficial farming practices that can help to meet this need include the use of efficient irrigation techniques (trickle, night time), growing crop varieties with lower nutrient/water requirements, minimal use of abstracted water, and growing non-irrigated crops. These practices will also provide benefits for biodiversity.</td></tr>
<tr><th colspan="2">Targets</th></tr>
<tr><td>EU Legislative Targets</td><td>• To promote the sustainable use of water and to mitigate the effects of droughts (Water Framework Directive 2000/60/EC)</td></tr>
<tr><td>EU Strategies, Action Plans etc.</td><td>• To introduce policy options to address and mitigate the challenges posed by water scarcity and drought within the Union (Addressing the challenge of water scarcity and droughts in the European Union COM/2007/0414)</td></tr>
<tr><th colspan="2">Legislative Baseline</th></tr>
<tr><td>EU Directives/Regulation</td><td>Water Framework Directive (2000/60/EC)
Not yet operational but farm level actions to achieve the objectives for each river basin will in some cases cover abstraction and use of water</td></tr>
<tr><th colspan="2">Current Policy Measures</th></tr>
<tr><td rowspan="2">Provide Direct Support</td><td>CAP Pillar 2 - EAFRD:
- Agri-Environment measure (214)</td></tr>
<tr><td>CAP Pillar 1:
- Cross-Compliance: GAEC Standards for minimum land management conditions</td></tr>
<tr><td rowspan="2">Partial Focus</td><td>CAP Pillar 2 - EAFRD
- Training and advice measures (111, 114, 115)
- Farm modernisation measure (121)
- Infrastructure Improvement and Development (125)</td></tr>
<tr><td>LIFE + programme</td></tr>
<tr><td>No Direct Focus</td><td></td></tr>
</table>

Policy Challenge 7: To Improve the Functionality of Agricultural Soils	
Well functioning soils deliver benefits for biodiversity, carbon sequestration and water infiltration and form the basis for food production. **There is a need to improve the functionality of all soils** to support sustainable food production, soil biodiversity and infiltration capacity, which will require improvements in the management of the many cultivated soils that are in a degraded state - suffering from erosion, compaction and reduced organic matter – often as a result of continuous arable cropping. Particularly beneficial farming practices include the use of green manure and, cover crops overwintered stubbles, contour ploughing or no ploughing on slopes, minimal or no-till cultivation for cereals, mixed rotations including arable and grazed livestock, and maintaining terraces for cultivation. These management practices will also provide benefits for landscape, biodiversity, water quality and carbon sequestration.	
Targets	
EU Legislative Targets	• None (although draft Soil Framework Directive under discussion COM(2006) 232) • To regulate the use of sewage sludge in agriculture in such a way as to prevent harmful effects on soil, vegetation, animals and man (Sewage Sludge Directive 86/276/EEC • To protect the environment as a whole by preventing or minimising emissions to all media (air, land and water) (IPPC 96/61/EC)
EU Strategies, Action Plans etc.	• To protect and ensure the sustainable use of soil by preventing further soil degradation and restoring degraded soils (Thematic Strategy for Soil Protection COM(2006) 231 Final) • To promote the sustainable use of soil, with particular attention to preventing erosion, deterioration, contamination and desertification (Sixth Environmental Action Programme 1600/2002/EC)
Legislative Baseline	
EU Directives/Regulation	Restrictions on inputs to soils in relation to the: • Nitrates Directive (91/676/EC) • Groundwater Directives (80/68/EEC and 2006/118) • Plant Protection Products Directive (91/414/EEC) • Sewage Sludge Directive (86/278/EEC) • Integrated pollution prevention and control (IPPC) Directive (2008/1/EC) NB: Proposed Soil Framework Directive (COM(2006) 232), if agreed, would also form part of the legislative baseline
Current Policy Measures	
Direct Focus	CAP Pillar 2 - EAFRD: - Agri-Environment measure (214) - Non-Productive investment (216)
	CAP Pillar 1: - Cross-Compliance: GAEC Standards for the retention of landscape features; avoiding the deterioration of habitats;

	minimum soil cover; retention of terraces; appropriate machinery use; arable stubble management; standards for crop rotations; establishment of buffer strips along water courses; permanent pasture - Article 68 special support for i) specific types of farming which are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Farm Modernisation measure (121) - Natura 2000 Payments (213)
	LIFE + programme
No Direct Focus	CAP Pillar 1: - Decoupled payments - Article 68 – support to address specific disadvantages in certain economically vulnerable or environmentally sensitive areas.

Policy Challenge 8: To Increase the Carbon Storage Capacity of Agricultural Soils

A significant volume of carbon is locked up in agricultural soils and semi-permanent vegetation. Carbon sequestration is recognised as an important strategy to mitigate rising concentrations of atmospheric CO_2, and to prevent further increases in global temperature. As part of a commitment to lowering the concentration of atmospheric $C0_2$, agriculture - as the dominant land-use in Europe and with a major impact on soil health/functionality - has an important role to play in preserving soil carbon stocks.

There is a need to manage agricultural soils and in particular, those with a high proportion of organic matter (for example, peat and land under permanent pasture and semi-natural vegetation, including woodland) **to avoid losses of carbon, and to manage mineral soils with a low carbon content** (for example, as a result of continuous arable cropping) **to increase their carbon storage capacity**.

Particularly beneficial farming practices in this regard include retaining high levels of groundwater on peat soils, and a high proportion of grass within the farm area. These farming practices will also have benefits for agricultural landscapes, biodiversity, soil functionality, and water quality.

Targets	
International Conventions	• To protect and maintain carbon stores (Kyoto Protocol, 1997).
EU Strategies, Action Plans etc.	• To protect and ensure the sustainable use of soil (Thematic Strategy for Soil Protection COM(2006) 231 Final).
Legislative Baseline	
EU Directives/Regulation	None
Current Policy Measures	
Direct Focus	CAP Pillar 2 - EAFRD: - Agri-Environment measure (214)
	CAP Pillar 1: - Cross-Compliance: GAEC Standards for avoiding the deterioration of habitats; maintaining minimum soil cover; protection of permanent pasture; establishment of buffer strips. - Article 68 special support for i) specific types of farming which are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Natural Handicap Payments (211/212) - Natura 2000 Payments (213)
	LIFE + programme
No Direct Focus	CAP Pillar 1: - Decoupled payments - Article 68 – support to address specific disadvantages in certain

	economically vulnerable or environmentally sensitive areas - Cross-compliance: GAEC standards for avoiding the encroachment of unwanted vegetation or minimum stocking rates.

Policy Challenge 9: To Reduce GHG Emissions from Agriculture

The agriculture sector in the EU is responsible for 9 per cent of total GHG emissions, largely from methane and nitrous oxides.

In line with a commitment under the Kyoto Protocol to reduce GHG emissions by 8 per cent across the EU by 2012 and to maintain temperatures within 2^0C of 1990 levels, **there is a need to reduce GHG emissions from agriculture** through a reduction in fossil fuels used for power and in mineral nitrogen fertilisers, as well as the emissions of methane (a highly potent GHG), in particular, associated with the livestock sector.

Farming practices associated with low GHG emissions per hectare include the use of livestock appropriate for the type of semi-natural vegetation, applying low levels of N fertilisers, use of legumes in the crop rotation and optimising soil drainage on non-organic soils. Farming practices associated with low GHG emissions per kg of meat/milk include use of high fertility livestock, use of multi-purpose livestock (milk and meat), high milking frequency, use of high digestibility and high nutrient content feed and a high proportion of maize silage (not grass silage). While both sets of farming practices are likely to also provide benefits for water quality, those practices associated with low GHG emissions per hectare will also provide farmland biodiversity and landscape benefits.

Targets

International Conventions	• To reduce atmospheric GHG Emissions (carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_20)) by 8% compared to 1990 levels by 2012 (Kyoto Protocol, 1997) – NB: Target does not relate solely to agriculture.
EU Strategies, Action Plans etc	• To fulfil the commitment of an 8 % reduction in emissions by 2008-12 compared to 1990 levels for the European Community as a whole, in accordance with the commitment of each Member State set out in the Council Conclusions of 16 and 17 June 1998 (Sixth Environmental Action Programme 1600/2002/EC) • To protect and enhance the EU's natural resources and landscapes in rural areas, the resources devoted to axis 2 should contribute to … climate change (Community Strategic Guidelines for Rural Development, 2007 – 2013 - 2006/144/EC)

Legislative Baseline

	National Emission Ceilings Directive (2001/81/EC): The Directive does not require specific farm-level action, but national programmes in place for the reduction of four pollutants, of which nitrous oxides are relevant for GHG emissions. Nitrates Directive (91/676/EC): in relation to limits on nitrogen inputs and other requirements under Member State Action Plans

Current Policy Measures

Direct Focus	CAP Pillar 2 - EAFRD:

	- Agri-Environment measure (214)
	CAP Pillar 1: - Article 68 special support for i) specific types of farming which are important for the protection of the environment; and ii) agricultural activities entailing additional agri-environment benefits
Partial Focus	CAP Pillar 2 - EAFRD - Training and advice measures (111, 114, 115) - Farm Modernisation measure (121) - Infrastructure development and improvement measure (125) - Natura 2000 Payments (213)
	LIFE + programme
No Direct Focus	CAP Pillar 1: - Decoupled payments - Article 68 – support to address specific disadvantages in certain economically vulnerable or environmentally sensitive areas - Cross-compliance: GAEC standards for avoiding the encroachment of unwanted vegetation or minimum stocking rates CAP Pillar 2 - EAFRD - Basic Services (321) - Village Renewal and Development (322).

<table>
<tr><th colspan="2">Policy Challenge 10: To Increase the Resilience of Agricultural Land to the Risks of Fire and Flood</th></tr>
<tr><td colspan="2">With predicted changes in temperature and rainfall patterns, certain parts of the EU are likely to experience increased drought and an associated risk of fire, and other areas are likely to experience higher rainfall and risk of flooding.

There is a need to promote those forms of agricultural land management – at the farm and landscape levels – that are well adapted to changing weather patterns, and improve resilience to the risks of fire and flooding.

Particularly beneficial farming practices for meeting this need include maintaining a high proportion of the farm area as permanent (>>10 years) semi-natural vegetation with appropriate levels of grazing and browsing; controlling the ground layer in permanent tree crops by grazing; leaving watercourses uncanalised; making use of flood or water meadows; practising transhumance; and the use of local breeds adapted to climate and semi-natural vegetation. These sorts of management practices will also provide benefits for landscape, farmland biodiversity, soil functionality, and water quality.</td></tr>
<tr><th colspan="2">Targets</th></tr>
<tr><td>EU Legislative Targets</td><td>• To reduce the probability of flooding and its potential consequences (Floods Directive 2007/60/EC).</td></tr>
<tr><th colspan="2">Legislative Baseline</th></tr>
<tr><td>EU Directives/Regulation</td><td>Floods Directive 2007/60/EC:
No legislative baseline at the farm level as yet. However, by 2015 mandatory measures will be introduced in through the development of measures to reduce flood risk by Member States.</td></tr>
<tr><th colspan="2">Current Policy Measures</th></tr>
<tr><td rowspan="3">Direct Focus</td><td>CAP Pillar 2 - EAFRD:
- Agri-Environment measure (214)
- Non Productive investments (216)</td></tr>
<tr><td>CAP Pillar 1:
- Cross-Compliance: GAEC Standards for the retention of landscape features; avoiding the deterioration of habitats; minimum soil cover; retention of terraces; appropriate machinery use; permanent pasture
- Cross compliance: Permanent pasture requirements under Article 6(2) of Council Regulation 73/2009</td></tr>
<tr><td>Selection of National Policy Measures
- UK – Sustainable Catchment Management Programme (SCaMP)</td></tr>
<tr><td>Partial Focus</td><td>CAP Pillar 2 - EAFRD
- Training and advice measures (111, 114, 115)
- Farm modernisation measure (121)
- Infrastructure Improvement and Development (125)
- Natural Handicap Payments (211/212)
- Natura 2000 Payments (213)</td></tr>
<tr><td>No Direct Focus</td><td>- CAP Pillar 1: Decoupled direct payments.</td></tr>
</table>

ANNEX XII SCENARIO ASSUMPTIONS

This Annex sets out the detailed assumptions that underpin the four scenarios in Chapter 8.

Annex Table 39 Scenario assumptions to 2020

	Reference	Liberalisation	Targeted Support
GDP	A conservative estimate of growth in European GDP assuming low growth rates and a fairly slow recovery period (OECD-FAO).		
Population Growth and Consumer Demand	Increasing global population, with the European population remaining stable, leading to increased demand for food globally, with higher demand for meat and dairy products in growing markets such as India and China. Within the EU, increasing demand for premium products (EU-15) and changing food demand (EU-12), with an increasing demand for dairy products.		
EU Enlargement	No further enlargement of the European Union		
Impacts of Climate Change	Differentiated impact across Europe. Reduced precipitation rates in southern Europe, leading to more frequent and prolonged drought, with increased competition for water resources and higher risk of fire. Increased precipitation rates in Atlantic and northern Europe, with more intense periods of rainfall and higher risk of flooding. Temperature rises more pronounced in central and north east Europe, leading to longer growing seasons in the north. More extreme weather events and increased year to year climatic variability. The areas conducive to cereal production are likely to move northwards which may lead to pressure for land use change from grass to arable. Potential invasion of new pests.		
Land and Rental Prices	Modest rises in land rental prices in those areas where there are no land market regulations, given strong positive correlation between agricultural commodity prices, productivity levels and rental prices. Higher rises in the EU-12 than in the EU-15.		
Input Prices	Higher average oil prices compared to those in the previous decade (1995-2005), leading to higher average prices for energy and fertiliser compared to the previous decade.		
Agricultural commodity prices	Real price increases in cereals. Meat prices are expected to be lower than those for 1997 – 2006. (DG Agriculture, 2009; World Bank, 2009; USDA, 2009; FAPRI, 2009)		
Price volatility	Input and output prices are subject to higher volatility, irrespective of the general long-term price trends, leading to increased risks and economic destabilisation resulting from market volatility.		
Technological Innovation	Technological advances assumed, including new approaches to crop management including modified irrigation regimes, new crop varieties that are resistant to disease, drought, salinity, heat etc, agro-ecological approaches, precision farming to reduce fertiliser applications and improve efficiency of input		

	use, reduced tillage, changing feed regimes to reduce methane emissions from livestock production. The impacts of GMO technology are not addressed in this study. Technological innovation will lead to productivity increases but these are likely to be less pronounced in EU-15 compared to the EU-12, where productivity increases are likely to be accelerated, especially in meat and dairy production.			
Climate and Energy Policy	Obligatory EU biofuel target at 10%. It is difficult to predict the extent to which this is met through domestic production compared to imported feedstocks, as the share of imports is limited due to a tariff on ethanol, the price of imported feedstocks and the impact of biofuel 'sustainability criteria'. GHG emissions from agriculture will decline to meet national emission reduction targets or as a result of EU initiatives for non-ETS sectors. Some degree of land use change in response to meeting targets for renewable energy, particularly increases in cropped areas for the growth of biofuel feedstocks at the expense of grassland. – wood, biogas, wind etc.			
Legislative Baseline	Assume no new EU / national / regional regulatory measures affecting agriculture, other than those required to implement existing EU legislation (e.g. Water Framework Directive) or other policy commitments (e.g. climate). Therefore, minimum disturbance to regulatory baseline although this implies some adjustment being made to Member State level measures to improve compliance with existing Directives, phase out derogations (e.g. of Nitrates Directive) etc.. Implementation of WFD implies considerable regulatory or equivalent action at Member State level, especially to reduce diffuse pollution. Cross compliance – Some changes in national cross compliance are assumed, as a result of the CAP Health Check agreement, but the detail of these is difficult to predict. Under the Liberalisation scenario, the regulatory baseline is likely to be debated, and farmers could be subjected to both reduced and increased regulatory requirements, depending on the environmental issue in question. The implementation and enforcement of regulations may be weakened in some Member States.			
	Reference	**Liberalisation**	**Targeted Support (a)**	**Targeted Support (b)**
Financial Perspective 2014-2020	Reduction of 24% of CAP budget in real terms – constant in nominal terms	No budget	Reduction of 24% of CAP budget in real terms – constant in nominal terms	Reduction of 24% of CAP budget in real terms – constant in nominal terms

Overall agricultural budget (Pillars One and Two) including national co-financing	In accordance with Health Check decisions (slight increase due to modulation and co-financing of additional EAFRD budget)	No budget	Total agricultural spending the same as under the reference scenario - national co-financing of Rural Development will therefore be reduced accordingly; basic and LFA payments are not subject to national co-financing.	Total agricultural spending the same as under the reference scenario - national co-financing of EAFRD will therefore be reduced accordingly. All payments to be co-financed.
Market policies	Balanced market, i.e. keeping public intervention stocks at 2% of domestic consumption (if stocks are too high support price will be decreased) without compensation	No intervention	= reference	= reference
System of intervention	Health Check Intervention system	No intervention	= reference	= reference
Level of intervention	Adjustment to balance markets	-	= reference	= reference
Cross Compliance	According to HC decisions	N/A	= reference	= reference – as applied to EAFRD
Direct Payment	Implementation of SPS as of 2013 - Full decoupling - almost no decrease in DPs in nominal terms (however, when phasing-in in EU-12, and slight increase of EAFRD is taken into consideration, DPs per hectare in most EU MSs will fall)	Removal of all payments No targeted Pillar Two support No national measures to counterbalance effects on land use	'Combined Pillar' approach: 1) 100 €/ha basic flat-rate payment 2) LFA-style top up payments in less favoured areas (two tiers: 50 or 100 €/ha) for maintaining land use; 3) Rural	Removal of all payments

Rural development	Additional EAFRD budget as decided for Health Check, with reduced national co-financing.		Development: EAFRD budget for rural development but excluding LFA, budget increase by 100 % (nominal), Axis 2 budget 40 % of total EAFRD (excluding LFA) Reduced national co-financing - rates to be determined to maintain overall budget at same level as under reference scenario.	Rural Development EAFRD budget, budget increase by 315%, Axis 2 budget 40 % of total EAFRD (including LFA). National co-financing rates reduced - rates to be determined to maintain overall budget at reference scenario levels.
Trade issues	WTO Agreement: stylised representation based on 'Revised Draft Modalities for Agriculture' (2008), with suggested amendments to blue box as well as to Annex 2 of the Agreement on Agriculture	Full liberalisation	= reference	= reference
Additional Trade Premises	Stylised representation of bilateral agreements, as decided, with: - EPA as decided. - EuroMed: full liberalisation	Full liberalisation	= reference	= reference

Annex Table 40 Budgetary assumptions under the four scenarios

in billion € p.a. (nominal)	2007	Reference	Liberalisation	Targeted Support (a)	Targeted Support (b)
Direct payments / basic payment	**37**	**36,5**	**0**	**18,4 ****	
LFA-style payment (PG-focused scenario only)			**0**	**8,0**	
Rural Development	**12,4**	**15**	**0**	**25,1**	**51,5**
Market support	**5,6**	**3,5**	**0**	**3,5**	**3,5**
Total	**55**	**55**	**0**	**55**	**55**
in % of 2007 (nominal)					
Direct payments		*99%*	*0%*	*50%*	*0%*
Rural Development		*121%*	*0%*	*202%*	*415%*
Market support		*63%*	*0%*	*63%*	*63%*
Total		***100%***	***0%***	***100%***	***100%***
in % of 2007 (real)*					
Direct payments		*75%*	*0%*	*38%*	*0%*
Rural Dev.		*92%*	*0%*	*154%*	*317%*
Market support		*48%*	*0%*	*48%*	*48%*
Total		***76%***	***0%***	***76%***	***76%***

*) with 2,1% inflation p.a. over 13 years ≈ factor 1,31

In current prices = nominal; in constant prices = real (deflated)

**) 100 € flat rate payment per hectare UAA in EU27