Addressing biodiversity and habitat preservation through measures applied under the Common Agricultural Policy

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ACRONYMS

ADAS	Agricultural Development and Advisory Services
ADE	Analysis for Economic Decisions
AEM	Agri-environment Measure
AES	Agri-environment Scheme
AT	Austria
CAP	Common Agricultural Policy
CBD	Convention on Biodiversity
CEC	Council of the European Commission
CMEF	Common Monitoring and Evaluation Framework
COWI	Consultancy within Engineering, Environmental Science and Economics
CSF	Common Strategic Framework
CY	Cyprus
DDT	Dichlorodiphenyltrichloroethane
DE	Germany
Defra	Department for Environment, Food and Rural Affairs
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
ECA	European Court of Auditors
EEA	European Environment Agency
EEG	Renewable Energy Sources Act (Germany)
EERP	European Economic Recovery Plan
EFBI	European Farmland Bird Index
EFTEC	Economics for the Environment Consultancy
EIA	Environmental Impact Assessment
ELS	Entry Level Stewardship (England agri-environment scheme)
ENRD	European Network for Rural Development
ERDF	European Regional Development Fund
ES	Environmental Stewardship (England agri-environment scheme)
ESF	European Social Fund
ETC/BD	European Topic Centre on Biological Diversity
ETIP	Entry Level Stewardship Training and Improvement Programme
EU	European Union
EU-12	The 12 Member States of the European Union which have joined since 2004.
EU-15	The 15 Member States of the European Union prior to the 2004 enlargement.
EU-27	All 27 Member States of the European Union.
FADN	Farming Accountancy Data Network
FERN	Non-governmental organisation looking at EU forests.
FTE	Full Time Equivalent

GAC	Good Agricultural Condition
GAEC	Good Agriculture and Environmental Condition
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GMOs	Genetically Modified Organisms
HNV	High Nature Value
ICM	Integrated Crop Management
ILUC	Indirect Land Use Change
IPARD	Instrument for Pre-Accession Rural Development
IPPC	Integrated Pollution Prevention and Control
IRENA	Indicator Reporting on the Integration of Environmental Concerns into Agricultural Policy
LEADER	Links between actions of rural development
LFA	Less Favoured Area
LIFE COEX	Financial Instrument for the Environment – Improving coexistence of large carnivores and agriculture in Southern Europe
LIFE+	EU Financial Instrument for the Environment
LPIS	Land Parcel Identification System
LT	Lithuania
LU	Livestock Unit
LU	Luxembourg
MAFRD	Ministry of Agriculture, Forest and Rural Development (Romania)
MEA	Millennium Ecosystem Assessment
MEKA III	Marktentlastungs- und Kulturlandschaftsausgleich (German agri-environment scheme)
Mha	Million hectares
MFF	Multi-annual Financial Framework
MoA	Ministry of Agriculture
MS	Member State
MSL model	Milchunas-Sala-Lauenroth model
MT	Malta
N	Nitrogen
NEGTAP	National Expert Group on Transboundary Air Pollution
NMS10	The 10 new Member States to the European Union who joined in 2004
NPK	Nitrogen – Phosphorus - Potassium
NW	North West
OECD	Organisation for Economic Cooperation and Development
PAF	Prioritised Action Frameworks
PECBMS	Pan European Common Bird Monitoring Scheme
PES	Payments for Ecosystem Services
pgr	Population growth rates
PRA	Predominantly Rural Areas

RBMPs	River Basin Management Plans
RDPs	Rural Development Programmes
RED	Renewable Energy Directive
RO	Romania
RSPB	Royal Society for the Protection of Birds
RuDI	Rural Development Instruments (FP7 project)
SACs	Special Areas of Conservation
SAPARD	Special Accession Programme for Agriculture and Rural Development
SAPS	Single Area Payment Scheme
SEA	Strategic Environmental Assessment
SEO	Spanish Ornithological Society
SI	Slovenia
SME	Small and Medium-sized Entreprise
SMR	Statutory Management Requirement
SPAs	Special Protection Areas
SPEC	Species of European Conservation Concern
SPS	Single Payment Scheme
TEEB	The Economics of Ecosystems and Biodiversity
UAA	Utilised Agricultural Area
UK	United Kingdom
WAO	Wales Audit Office
WTO	World Trade Organisation

EXECUTIVE SUMMARY

Based on a thorough review of the relationship between agriculture and biodiversity, the purpose of this study is to consider how policies, particularly the Common Agricultural policy (CAP), have worked in terms of their design, coordination and implementation for sustaining biodiversity and associated ecosystem services through agriculture, and how their role can be enhanced in the future to contribute towards meeting the EU's biodiversity goals. The interactions between forest management and biodiversity were out with the remit of this study. It considers the impacts and effectiveness of the current suite of policy measures, both within and outside the CAP, on delivering biodiversity benefits through agriculture and mitigating adverse agricultural impacts. Stepping back from a purely agricultural focus, the study also considers how biodiversity associated with farmland can be delivered alongside other economic and social priorities in rural areas. It concludes by discussing the policy developments needed, particularly within the CAP, to ensure that biodiversity associated with agriculture is delivered as a strategic priority.

The study uses the widely accepted definition of biodiversity, as set out by the Convention on Biological Diversity (CBD): 'biological diversity means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'. Biodiversity, therefore, is understood as relating not just to species, but also to genetic diversity, habitats and ecosystems. The EU's headline target of halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, also concerns all these components. Furthermore, it is important to note that biodiversity conservation does not just focus on rare and threatened species and habitats listed in the Birds and Habitats Directives. The maintenance of populations of widespread and common species, including those of agriculture habitats is also a serious concern. Such species may not necessarily be protected by EU legislation, but underpin some ecosystem services, are regularly encountered, enjoyed and therefore valued by the EU public.

The evidence draws on a wide range of secondary sources, including scientific literature, evaluation studies, an in-depth analysis of the policy framework, along with detailed information collected from six case studies conducted in the Czech Republic, France, Germany, Greece, Romania and the UK.

The importance of sustaining biodiversity through agriculture

The importance and value of biodiversity for human well-being is recognised increasingly both in Europe and globally for its intrinsic and cultural worth, as well as its role in providing essential ecosystem services. Indeed, amongst the European public, there is widespread concern for the environment and biodiversity in particular.

The EU Biodiversity Strategy, adopted in 2011, stresses the importance of the agricultural sector in meeting the EU's headline biodiversity target. The Strategy includes a specific objective to 'maximise areas under agriculture across grasslands, arable land and permanent crops that are covered by biodiversity-related measures under the CAP so as to ensure the conservation of biodiversity and to bring about a measurable improvement in the conservation status of species and habitats that depend on or are affected by agriculture and in the provision of ecosystem services as compared to the EU 2010 Baseline, thus contributing to enhance sustainable management'.

Agriculture covers about 40 per cent of the total land area of the EU-27 and its management has substantial impacts, both positive and negative, on the functioning of natural systems. Over time, agriculture has contributed to the creation of a rich diversity of habitats and landscapes, including semi-natural habitats of high biodiversity value. However, structural changes in agriculture in the second half of the twentieth century have led to increased intensification, concentration and specialisation of production in some areas and marginalisation and abandonment in others, leading to significant biodiversity losses across the farmed landscape. A number of drivers have encouraged these trends, including support under the CAP and exogenous drivers such as trends in agricultural commodity prices, changes in technology, trade agreements, and more recently climate change. These trends do not just impact upon farmland biodiversity, but also on the provision of several ecosystem services, such as water quality, soil health, and air quality.

Interactions between Agriculture and Biodiversity

The pattern of biodiversity found today in Europe is primarily a result of thousands of years of human interaction with the environment. As agriculture expanded in Europe, a variety of low-intensity traditional agricultural practices developed over time that were suited to the varying climates, topography and soils, creating in the process a rich diversity of farmland landscapes and new habitats. The novel species communities that developed initially probably increased species richness across much of Europe. Some of these semi-natural habitats, such as wood pastures, hay meadows, scrubland and heathlands, survive today, and continue to be managed by farmers and graziers. A key characteristic of many of these habitats is that natural succession is prevented by grazing, cutting of grass and, in certain parts of Europe, carefully controlled burning practices. Livestock farming and the associated low-intensity practices have played a significant role in this and their continuation is often crucial for their survival. Some of the natural non-forested habitats that developed after the last ice-age in Europe, such as tundra, blanket bogs, montane grasslands and salt-steppes, can be considered to be agricultural habitats as well as they are grazed to some extent, although they are generally not dependent on this for their continued existence.

However, the rapid changes in agricultural development over the past decades have led to significant productivity gains in the most fertile areas of the EU through processes of intensification, concentration and specialisation. This has created highly modified and simplified agricultural habitats and landscapes that are hostile to many wild plants and animals (for example as a result of frequent cultivations, the use of pesticides, fertiliser, and the presence of highly competitive crop cultivars) and often no longer provide sufficient food resources for the species that could otherwise tolerate the changed conditions.

There is broad agreement within the scientific literature that the majority of species of high conservation importance are associated with semi-natural habitats and natural habitats. In general, biodiversity value (taken as the diversity of characteristic species and rare species) declines with increasing agricultural improvement, specialisation, concentration and intensification and the accompanying changes in practice required to increase efficiency.

The key factor that determines the level of biodiversity associated with agricultural habitats is therefore the degree to which they have been modified from their natural state as a result of grazing, one-off or occasional agricultural improvements (ie drainage, ploughing and reseeding) and/or routine intensification or modernisation of management, such as cultivations, the use of fertilisers, irrigation and pesticides etc. It is important to note that highly productive farming systems within modified and intensive croplands and temporary grasslands do retain some widespread and adaptable species, particularly birds, although they have low species diversity and support very few invertebrates, plants, birds or other fauna of high conservation importance. Because these are often the last visible vestiges of nature in many farmland landscapes they are particularly appreciated by the wider public and consequently have high cultural values.

Through an analysis of monitoring data specifically related to agricultural habitats, this study reaffirms the findings in the EEA's 2010 Biodiversity Baseline report that a particularly low proportion of agricultural habitats have a favourable conservation status. Monitoring data on the status of Annex I habitats under the Habitats Directive demonstrates that considerable improvement in the condition of these habitats is needed if the aims of the Habitats Directive are to be met. Recent research identified 63 habitats (out of 231 listed in Annex 1) that are dependent on agriculture to some extent, 25 of which are considered to be fully dependent on agricultural activities and are therefore particularly sensitive to agricultural abandonment.

Monitoring data on birds and butterflies in recent decades also provide evidence of substantial declines in species populations and species richness, particularly in improved grassland and intensively cultivated habitats. Such declines are now increasingly consistent across all EU countries, although declines have been greatest in the EU-15. As a result, common farmland bird populations have declined by 20 per cent since 1990, and by approximately 50 per cent since 1980, although these pre-1990 trends are less certain. There is some indication that the rate of decline may have levelled off, but scarce farmland birds (including those of extensive cereal systems and permanent crops) of high conservation importance continue to decline. Butterfly data seem to indicate steeper declines, especially amongst semi-natural grassland species. European-wide monitoring data on plants and other taxa groups are not available, but various national studies consistently show very high rates of decline in species diversity in improved grassland and intensively cultivated farmland habitats.

As a framework for this study, a field scale typology of agricultural habitats was developed according to their relative biodiversity value, which identifies the type of vegetation associated with each habitat, the number of priority habitats and species (as classified under the Birds and Habitats Directives) associated with them as well as the principal management needs for each habitat in terms of fairly specific agricultural practices. The typology distinguishes between permanent grasslands grazed by livestock and other forms of natural or semi-natural vegetation; improved grasslands; cultivated croplands, including temporary grassland; and permanent crops. The framework is also used to illustrate the potential for maintaining and enhancing biodiversity through agriculture, as well as the range of agricultural practices that can sustain biodiversity in each particular type of habitat.

The potential for agricultural practices to maintain and enhance biodiversity differs amongst habitats, primarily depending on their biodiversity value. Natural habitats are generally not dependent on grazing, and many are sensitive to grazing levels. The main priority for such habitats is therefore to ensure that if grazing occurs it is appropriate. In contrast many semi-natural habitats, are highly dependent on the continuation of a number of beneficial agricultural practices (such as extensive grazing with appropriate livestock, traditional haymaking and traditional agro-forestry), which may be lost through either intensification or abandonment. Extensive agricultural management can also contribute to the restoration of rare and fragmented semi-natural habitats, which is a priority in some areas. In agriculturally improved/intensive habitats, the priority is to modify farming practices to avoid, or reduce to acceptable levels, impacts on important non-agricultural habitats such as wetlands (eg through buffer strips to reduce the run-off); to maintain unfarmed features such as hedges, fallow areas, patches of scrub, trees, ditches and ponds, which act as foraging and breeding sites and help to create ecological connectivity in fragmented farmland landscapes. Mixed farming systems and the use of crop rotations (especially with fallow land) within arable systems also help to maintain landscape-scale diversity, which is important in semi-natural and more intensively farmed landscapes.

Future trends in agricultural re-structuring are likely to have mixed implications for biodiversity and further biodiversity losses are likely to occur. Further intensification is likely to exert greatest pressures on the EU-12 Member States, because there is considerable scope for further farm investment, restructuring and technological improvement in the region. This will have substantial biodiversity impacts as many of Europe's most threatened agricultural habitats and species remain in these regions, mainly as a result of their lower intensity farming. In addition, significant areas of semi-natural habitats and other High Nature Value farmland are expected to be especially vulnerable to much reduced management and land abandonment (especially in more marginal areas), which will generally have detrimental impacts where large proportions of the landscape are affected.

The effectiveness of policies and measures promoting biodiversity through agriculture

The CAP is the most important funding instrument at the EU level with potential to deliver biodiversity associated with agriculture at a European scale given that it influences the management of the majority of agricultural land. Maintaining, enhancing and restoring biodiversity has been one of the key priorities to be addressed by environmental measures within the CAP since they were introduced in the 1980s/1990s, with the main focus being on measures to influence land management practices. The agri-environment measure continues to be the most significant one in this regard, both in terms of the financial resources allocated to it and its spatial coverage. Under Pillar 1, cross-compliance is the main measure currently to have biodiversity as an objective. However, a whole range of other CAP measures can also be used to deliver biodiversity, both within Pillar 1 and Pillar 2. Environmental legislation evidently also plays a key role, for example the requirements of the Birds and Habitats Directives, including the creation of the Natura 2000 network. Other EU environmental legislation, such as the Water Framework Directive and the Nitrates Directive also can help to protect and enrich agricultural biodiversity, for example by reducing the use of fertilisers and pesticides, with beneficial knock-on effects on species and habitats.

While real progress has been made in recent years with efforts to reverse the declines in agricultural biodiversity in the EU, the pressures facing biodiversity are such that this has been insufficient to meet the targets that were set for 2010. There are a range of reasons why this is the case. However, it is clear that the current policy framework provides a good foundation on which to build to make the changes needed if the new 2020 biodiversity targets and the related agricultural targets under the new Biodiversity Strategy are to be met in the next eight years. To this end, as part of the current reform of the CAP, the Commission is proposing to enhance its contribution to biodiversity by introducing new compulsory environmental measures linked to direct payments within Pillar 1.

With respect to the current CAP, the following measures are of particular importance for the delivery of biodiversity policy goals:

Agri-Environment: As the only measure in Pillar 2 of the CAP that is compulsory for Member States to implement, the agri-environment measure is the primary policy measure used to encourage farmers to adopt management practices that are beneficial to biodiversity. One of the merits of the measure is its flexibility, which allows Member States to develop voluntary schemes that reflect different bio-physical, climatic, environmental and agronomic conditions to suit local conditions. A number of scientific studies have confirmed that as a whole, the biodiversity status of agricultural habitats subject to agri-environment measures is significantly better than would have been the case if the policy had not been in place. There is good evidence that well designed and implemented agri-environment measures have been critical in maintaining and restoring biodiversity in many areas.

In semi-natural habitats, the agri-environment measure has been used for highly targeted and tailored schemes for the conservation of threatened habitats and species (often being the key means of achieving appropriate management in Natura sites), as well as encouraging the maintenance of low intensity management on High Nature Value (HNV) farmland in the wider countryside. There are a number of examples of agri-environment schemes that have been successful in supporting HNV farming, thereby maintaining semi-natural wooded pasture habitats (Sweden, Estonia), hay-meadows and mountain pastures (Slovakia, Romania), the restoration of overgrazed pastures (Bulgaria), moorland grazing (the UK) and traditional agro-forestry systems in Spain ('dehesas'). Support for traditional local breeds, either through their use in management options within agri-environment schemes targeting the HNV farming, or through specific agri-environment schemes for genetic resources, has been essential for stemming their decline. Agri-environment schemes targeting HNV farmland have not been beneficial just for biodiversity, but have also provided a range of other environmental benefits and supported ecosystem services. By making it possible for such systems to continue, agri-environment schemes indirectly support the ongoing contribution they make in the local economy, contributing to employment and providing a basis for diversification activities.

It is critical to use an effective combination of measures to deliver sustainable outcomes for biodiversity in semi-natural habitats, particularly in economically lagging areas. For example, in a variety of regions the agri-environment measure has been used in combination with several other CAP Pillar 2 land-based area payments to pursue biodiversity outcomes, for example the Natura 2000 payments and the compensation measure for 'less-favoured areas' (LFA payments). Other measures have also been shown to play an important role if used appropriately, for example those that provide support for farmer advice, training, information, and extension services; certain capital investments associated with farm modernisation, non-productive investments and the infrastructure measure; support to producers associations for quality products; diversification into non-agricultural business activities, and the participatory Leader approach.

Although the overall evidence is variable, it suggests that agri-environment measures have also proved successful in delivering benefits for widespread and common species in improved grasslands and intensive croplands. The benefits associated with agri-environment measures for intensive croplands are found mainly in instances where a combination of management options provide key ecological resources for vulnerable species, in particular breeding habitat and year-round food resources, as these tend to be reduced by agricultural intensification and specialisation. The main priority for most of the declining species of such habitats (especially birds), are measures that provide in-field resources (such as fallow patches or fields, over-wintered stubbles, diverse crops and crops with reduced pesticides). However, some species also benefit from field edge management measures, such as the planting of field margins with seed-rich or nectar-rich plants, or reductions in the use of pesticides in field headlands. Maintaining populations of common species has often proved to be more of a challenge due to the scale of response that is needed, but there have been some successes and recent initiatives are encouraging. A range of factors affect the outcomes of agri-environment schemes, a number of which are unrelated to policy or agricultural management. These include variations in climate and weather; the hunting or killing species inside and outside Europe; invasive alien species; predators, including large carnivores, such as bears and wolves; non-agricultural habitat loss taking place both inside and outside Europe that affects migratory species; and incompatible management taking place on neighbouring land.

Cross-compliance: Certain of the cross-compliance requirements now specified in the CAP are important for ensuring basic levels of management that can support biodiversity on farmland. By requiring a certain level of management to be carried out as a condition both for receipt of direct payments and for area based agricultural payments under Pillar 2, cross-compliance can help constrain the potential adverse impacts of both the intensification and marginalisation of agricultural habitats (through the standards of Good Agricultural and Environmental Condition – GAEC). The Statutory Management Requirements (SMRs) help to reinforce the application of environmental legislation. The evaluation of the impact of these measures on biodiversity at a pan-European level is urgently needed, as many of these standards have been changed since 2005, or introduced more recently, and little current information exists on which an assessment of their effectiveness can be based.

Direct Payments: Direct payments themselves are not focussed directly on the delivery of biodiversity. However, they provide the basis for cross compliance requirements, and as a result of this link, direct payments can influence farmers' awareness and behaviour relating to certain biodiversity concerns. They play a role in stabilising farm incomes which in this context is particularly significant for those farms that are economically vulnerable and managing land that is important for biodiversity. As such, they provide a basis for more targeted measures under the second pillar. There is scope for targeting these payments more on environmental objectives in future, as the Commission is proposing.

Certain eligibility issues relating to the implementation of direct payments unintentionally have led to locally specific damage to biodiversity in some Member States. Because farmers are at real risk of losing direct payments when their land does not comply with the eligibility rules applied at national level, or with certain GAEC provisions, they are strongly motivated to change the management of their land to minimise this risk. In some instances, where cross compliance or eligibility issues are unclear or interpreted incorrectly, farmers have removed vegetation in semi-natural habitats for fear of being penalised. In other cases, environmentally beneficial habitats have been deemed ineligible for direct payments in particular regions, heightening the risk of land eventually being taken out of farming and abandoned. Therefore there is a widespread concern about the large areas of land which currently, for a variety of reasons, are not declared or not eligible for direct payments, which include some of the most extensive and ecologically valuable permanent pastures, including those listed under the Birds and Habitats Directive in Estonia, Bulgaria, Romania, Slovakia, Sweden, Spain, Scotland, Northern Ireland and France (alpine meadows).

More broadly there is a need to develop a coherent policy response to farmland biodiversity, where measures work synergistically and perverse effects are avoided. In particular, the development of appropriate mixes of widely applied generic measures and more targeted and tailored measures is essential for all policies to have their desired ecological impacts. However, measures also need to be sufficiently accessible and attractive to farmers to ensure adequate levels of uptake. Advice and information provision alongside training and the development of skills have therefore also been shown to be a key factor influencing the successful implementation of policy measures to deliver biodiversity outcomes in many regions. This is true for voluntary measures, such as agri-environment schemes, as well as for regulatory requirements and GAEC standards. Certain institutional and governance factors are also demonstrated to be important to help maximise the successful design and implementation of policy measures in practice.

They include having the appropriate administrative and technical resources and expertise in place in public authorities, including appropriately trained staff who understand the dynamic interactions between agriculture and the environment. Adequate databases, and suitable systems need to be in place to be able to target and monitor measures well, to deliver payments efficiently and to ensure effective control and enforcement. Finally, it is important to recognise that policy measures under the CAP do not operate in isolation. They interact with a range of other policies. The use of biodiversity focussed measures in the CAP, therefore, needs to be identified as an integral part of broader national biodiversity strategies that identify the range of policy instruments to be used to meet biodiversity goals

Biodiversity in a sustainability perspective

The economic, political and environmental context within which measures to promote biodiversity oriented land management practices are operating is not static, and is influenced by a wide range of policy and non-policy drivers. Indeed, Europe's biodiversity goals must be met, while simultaneously addressing priorities for the broader economic, social and environmental sustainability of rural areas, including addressing new challenges such as climate change.

Different trends in the development of rural economies and rural communities exert a variety of pressures on biodiversity. In the past, policies stimulating economic growth in rural areas often have taken inadequate account of biodiversity and damage has occurred as a result. In considering the relationship between biodiversity and policy objectives for the socio-economic development of rural areas, for ensuring the viability and competitiveness of the agricultural sector and for achieving climate goals, there are clear opportunities for using biodiversity as an economic asset, as part of the solution for achieving sustainable development in rural areas.

In particular the 'green growth' agenda may offer opportunities to biodiversity both through the development of green technologies that can limit agriculture's impact on the environment, and also through wider economic initiatives, for example through sustainable tourism and on-farm biodiversity management activities etc. Adequate biodiversity protection also is essential for the provision of many ecosystem services which are needed to underpin economic activities. Perhaps more fundamentally biodiversity, especially with regard to healthy soils, is also critical for the long term productivity and sustainability of agriculture and will therefore play a key role in ensuring food security in the future.

However the degree to which these synergies can be built upon as part of future trajectories for the development of rural areas will vary in Europe. A typology of rural areas is used to help distinguish between the different opportunities, synergies and conflicts that may occur and how these might be maximised or prevented in different situations. This shows that areas which are lagging economically are of particular concern, for example areas where agriculture remains small-scale and unmodernised and which suffer from remoteness and declining populations. In these areas there is particular pressure for rural economies to develop and become more competitive while the implications for biodiversity can be particularly sensitive. Finding ways of achieving sustainable solutions for these areas is paramount. Indeed, the long-term sustainability (economic and social as well as environmental) of rural development pathways is a key concern for biodiversity and public policy, including the CAP's rural development policy, plays a key role in supporting this.

Opportunities do exist. For example, agriculture can be 'embedded' within a wider regional economy and community in ways which reinforce the direct economic value of biodiversity as a feature of farming systems and practices, as is the case with organic farming, or high value-added products linked to farming practices which protect biodiversity in concrete ways, or eco-tourism or low-impact, sustainable leisure developments which celebrate and protect biodiversity.

The occurrence of 'win-win' situations where biodiversity is supported by sustainable rural development depends, to some extent, on the nature and extent of valued ecosystem services associated with farmland biodiversity. However, it also requires elements of human and social capital in the form of strong environmental awareness and cultural support for biodiversity, significant institutional capacity, to devise and manage solutions as well as strong links between the protection of natural assets and rural economic activity. The existence of a mix of policy and non-policy drivers that is able to maintain a degree of balance and stability in the farmed landscape (of farm structures, farming communities and their skills and knowledge) for relatively biodiverse agricultural habitats managed by longstanding agricultural practices, is indeed important. These need to be developed where they do not currently exist.

There is much evidence to suggest that where farmers have a high level of awareness of the environmental implications of their management practices, where there is good cooperation between different government departments and stakeholders and where institutions are well-informed about biodiversity, its value to economic development and its requirements, protection and enhancement are much more likely to occur. Conversely, evidence indicates that a lack of such institutional capacity and/or farmer awareness can create significant barriers to the effective adoption and implementation of biodiversity-friendly policies and practices. In essence, greater understanding among both policy beneficiaries and policymakers/administrators will favour biodiversity conservation and help to reinforce synergies and avoid conflicts when policies are designed and implemented through locally responsive and partnership-based approaches.

Achieving biodiversity conservation through agriculture as a strategic perspective

Delivering biodiversity and ecosystem services through the agricultural sector cannot be seen in isolation from the delivery of other environmental, social or economic objectives. Therefore, although the CAP will continue to play a central role, the broader context is also critical.

Finding the right balance between the delivery of 'non productive' ecosystem services from agricultural land, such as water quality, pollination, valued landscapes and of course biodiversity itself, and creating favourable conditions for producing crops, livestock and energy is a challenge in view of ensuring the long term sustainable management of land. Issues in relation to the use of land for biofuels and the deployment of new technologies will have to be addressed quite urgently as part of this challenge.

Consequently, an integrated approach is required that can identify win-win opportunities wherever possible, whilst recognising the importance of potential conflicts and trade-offs that may need to be made. Solutions on the ground will vary in different parts of the EU-27, according to local conditions. Some will require the maintenance of existing farming systems and land management practices, while others will require changes to be made, particularly within more intensive farming systems. In some cases, highly tailored and targeted policy measures are needed that are focussed on the specific management needs of a particular species or habitat in a particular location. In other situations a few simple requirements that can be applied across the whole farmed landscape are needed. A complete strategy involving the CAP also needs to address the underlying viability of farming systems and structures, particularly where these are linked strongly to the provision of biodiversity. Increasingly, innovation in production methods and/or management practices will be needed in order to find ways of increasing food production in the long term, without damaging the environment and biodiversity. To meet these priorities, a spectrum of measures is needed within the CAP, from the highly specific to the broader brush.

Of the current policy measures available, the most beneficial for biodiversity is the agri-environment measure. This measure is particularly flexible and can be designed to deliver both targeted and tailored activities as well as simpler management adjustments across the farmed countryside. Since sustained and appropriate management over a period of years is often important to secure biodiversity benefits, a measure which can deliver this over a specified and extended period of time is of particular value. The contractual nature of the agreement is therefore important; it provides a frame within which the requirements, the timescale concerned and the payment to be made are set out clearly. Since it is binding, it also ensures a sustained commitment by the farmer, who has the certainty of receiving the corresponding payment upon compliance.

However, the voluntary nature of agri-environment schemes, combined with the limited funding available through Pillar 2 means that there are limits to what can be achieved for biodiversity through this measure on its own. The legislative proposals for the reform of the CAP from 2014 onwards have suggested the introduction of generalised, annual payments for mandatory 'agricultural practises beneficial for the climate and the environment' into Pillar 1. These are linked to direct payments, as one means of achieving greater benefits for biodiversity, particularly for common and widespread species, across the farmed countryside (COM(2011) 625/3). These proposals represent a significant shift in the composition of direct payments, with the proposal to allocate a substantial proportion (30 per cent) of direct payments into payments for delivering environmental benefits, with the measures having a very wide reach.

Identifying simple one-size-fits-all annual management practices that can provide significant environmental benefits is not straightforward, because ecological requirements are typically context-specific. However, three measures have been proposed that could be implemented on this basis – ecological focus areas, maintenance of permanent grassland and crop diversity. Amongst the proposals, the measure that perhaps has the most potential to deliver additional environmental benefit is the 'ecological focus area', which requires a proportion (seven per cent is proposed) of a farm's eligible hectares (excluding land under permanent grassland) to be allocated for ecological purposes, for example as landscape features, buffer strips or fallow land. This undoubtedly has the potential to provide important biodiversity benefits, such as for birds, mammals and invertebrates, as well as benefits for aquatic biodiversity as a result of reduced run off and pollution of water courses. However, the actual magnitude will depend on the precise details of this measure, which are not yet clear. Furthermore, the benefits for biodiversity could be increased significantly by the targeting and appropriate tailoring of management practices on the land concerned, which in many cases might be achieved through the use of agri-environment agreements.

Requiring permanent pasture to be maintained at the farm level should also deliver some biodiversity benefits. The most widespread impacts would be in terms of constraining the conversion of improved grasslands to temporary grasslands and arable crops (eg maize), with benefits for soil condition and biodiversity, and knock-on benefits higher up the food chain, as well as for aquatic biodiversity. The conversion of semi-natural grasslands, which are of particularly high biodiversity value, to temporary grassland or arable would also be constrained, although the risks they face from agricultural improvement or abandonment will need to continue to be addressed through other measures, such as the agri-environment measure. Furthermore, the use of 2014 as the reference year for the area of permanent grassland to be maintained may give farmers an incentive for the conversion of permanent grassland in the interim. As a transitional measure the Commission has proposed to extend the current national permanent pasture cross compliance for a few years.

Introducing more diversity into cropping patterns, particularly where large scale monocultures predominate currently, has the potential to bring modest benefits for biodiversity. There is little evidence, however on what the precise biodiversity impacts are likely to be, although it is likely to benefit more common and widespread species due to improvements in soil biodiversity and overall invertebrate populations. As with any biodiversity measure, however, impacts will be context specific.

The 'greening' measures should not be seen in isolation. They should provide a broad foundation on which more focussed agri-environment schemes under Pillar 2 can build. Importantly, Member States will then have the flexibility to use the proportion of the budget currently allocated to the agri-environment measure to incentivise more tailored and targeted management activities.

The environmental potential of all broad brush measures can be maximised by appropriate design of the detailed rules, followed by sensitive and diligent implementation on the ground and monitoring of impacts to identify necessary refinements. The existence of a suitable suite of EU measures within the CAP regulations is therefore only the first step. Subsequently more detailed design and implementation of measures at the Member State or regional level, using broad brush and more targeted approaches in combination, is essential to address local biodiversity needs effectively.

Whichever policy approaches are used and in whichever combination, adequate funding is essential. In addition, there are a number of other common principles that need to be included within the policy architecture to ensure effective delivery for biodiversity. These include:

- the need for clear strategic objectives to set out the key priorities for the policy (or policies) in question, providing a framework within which more detailed policy

measures can be established and to ensure coherence between different elements of the policy;
- sufficient discretion designed into the policy to allow Member States to use measures in the most appropriate combinations and design policy responses that are regionally specific to address the priorities and needs identified locally;
- mechanisms to secure cumulative benefits over a period of years and allow longer term objectives, such as habitat restoration, to be achieved; and
- meaningful monitoring and evaluation.

Institutional capacity is a significant limiting factor in the effective delivery of biodiversity outcomes through agriculture and addressing this is seen as a key priority.

Although the CAP has an important potential to contribute to biodiversity outcomes on farmland, the achievement of biodiversity goals associated with agriculture cannot be seen in isolation from factors outside policy altogether, other policies specifically focussed on biodiversity and habitats (for example the Birds and Habitats Directives, the LIFE+ programme and the implementation of the Natura 2000 network), and locally specific policies, such as land use planning, even if biodiversity goals are not their prime focus. Achieving biodiversity goals through the CAP may become more difficult or more costly if other policy processes are pulling in different directions and the value of biodiversity to society is not fully recognised.

In relation to agricultural land use and biodiversity, a key issue is the increased competition for land for different purposes. Increasing demands on land as a basis for agricultural production risks putting even further pressure on the delivery of environmental services, including biodiversity over the coming decade. As biodiversity comes under increased pressure public intervention is therefore justified to address the undersupply of these public goods.

Alongside measures within the CAP, integrating biodiversity goals within those of other EU funds and policies will help to maximise synergies and allow biodiversity to be seen as a component part of achieving other EU and national policy goals. Although biodiversity does not feature strongly within the EU2020 strategy, the recently published Roadmap for a Resource Efficient Europe, taking forward the sustainable growth objective of the EU2020 strategy, gives considerable emphasis to biodiversity, placing biodiversity and ecosystem services near the heart of its vision for 2050. The legislative proposals for the new CAP aim to integrate these principles into future support for the agricultural sector and rural areas , supporting employment and growth, promoting innovation and enhancing both the 'economic and ecological competitiveness' of agriculture.

Conclusions

A step change is needed to be able to meet the new 2020 biodiversity targets for agriculture, and this requires action on several different fronts. Of all the EU funding policies, the CAP has the greatest potential to deliver biodiversity on farmland and its relationship with the Biodiversity Strategy is of key importance for delivering the EU's 2020 targets for biodiversity. To achieve such a step change, some unresolved issues need the attention of policy makers at different levels of governance:

- Firstly the spatial scale over which agricultural biodiversity is delivered needs to be increased significantly and the efficiency and effectiveness of measures improved to ensure that biodiversity thrives in the wider countryside as well as in protected areas.
- Secondly the legislative framework currently in place to protect Europe's most valued biodiversity needs to be fully implemented and adequately enforced to provide a sound foundation on which other policy measures can build.
- Thirdly, sufficient public funding needs to be available to support biodiversity provision on agricultural land, above and beyond that which is required by law. Estimates on the scale of funding required indicate that significant increases are needed compared to the amounts that are currently available. Funding from both pillars of the CAP will be the main source of financing and appropriate mechanisms are required to guide Member State expenditure in this direction. Expenditure under the CAP, whether green payments in Pillar 1 or EAFRD rural development plans, needs to be linked to plans at the national level to deliver on biodiversity targets.
- Fourthly, the report highlights the importance of using combinations of measures to provide integrated packages of support to farmers. A balanced programme of measures would combine those concerned with agri-environment management with those designed to support capital investments in farms and rural areas, measures to secure the economic viability of farms and rural areas (for example, access to markets, diversification, creation of micro-enterprises, encouragement of rural tourism, and conservation of rural heritage); and measures to develop the skills and capacity of farmers (for example, extension services, provision of information, advisory and training). More emphasis should be given to developing these packages and a lot can be gained from their utilisation in a more systematic way. Also, in light of the proposals for the reform of the CAP It will be crucial that Pillar 2 measures are designed and targeted by Member States in ways that build upon the greening requirements in Pillar 1.
- Finally, the role of innovation in fostering sustainable land management needs to be encouraged to allow any increases in agricultural production to be carried out in a sustainable way, taking account of the needs of biodiversity and the provision of the full range of ecosystem services.

RESUME

Fondée sur un examen approfondi de la relation entre agriculture et biodiversité, cette étude a pour but de considérer comment les politiques, en particulier la Politique Agricole Commune (PAC), ont agi, sous l'angle de leur conception, coordination et mise en œuvre, pour préserver, à travers l'agriculture, la biodiversité et les services écosystémiques qui y sont associés, et comment leur rôle peut être renforcé, dans le futur, pour contribuer à atteindre les objectifs de biodiversité de l'UE. Les interactions entre la gestion forestière et la biodiversité ne relevaient pas de la mission de cette étude. Elle examine les impacts et l'efficacité de l'actuelle panoplie de mesures de politiques, à la fois dans et en dehors de la PAC, pour l'obtention, à travers l'agriculture, de bénéfices en matière de biodiversité et pour atténuer les impacts négatifs de l'agriculture. En adoptant un point de vue plus large qu'une focalisation purement agricole, l'étude considère également comment, dans les zones rurales, la biodiversité associée aux terres agricoles peut être obtenue aux côtés d'autres priorités économiques et sociales. En conclusion elle examine les développements de politiques requis, particulièrement au sein de la PAC, pour garantir que des résultats sur le plan de la biodiversité associée à l'agriculture soient obtenus, en tant que priorité stratégique.

L'étude utilise la définition largement acceptée de la biodiversité, telle qu'établie dans la Convention sur la Diversité Biologique (CDB) : «diversité biologique signifie variabilité des organismes vivants de toute origine y compris, entre autres, les écosystèmes terrestres, marins et autres écosystèmes aquatiques et les complexes écologiques dont ils font partie ; cela comprend la diversité au sein des espèces et entre espèces ainsi que celle des écosystèmes ». Par conséquent, la biodiversité est comprise comme se rapportant non seulement aux espèces mais aussi à la diversité génétique, aux habitats et aux écosystèmes. L'objectif prioritaire de l'UE d'enrayer la perte de biodiversité et la dégradation des services écosystémiques dans l'UE d'ici à 2020 et d'assurer autant que possible leur rétablissement, concerne aussi tous ces éléments. De plus, il est important de noter que la conservation de la biodiversité n'est pas seulement axée sur les espèces et habitats rares et menacés listés dans les Directives Oiseaux et Habitats. Le maintien des populations d'espèces répandues et communes, y compris celles des habitats agricoles, est aussi un sujet important de préoccupation. De telles espèces ne sont pas nécessairement protégées par la législation européenne mais elles sous-tendent certains services écosystémiques, sont régulièrement rencontrées, appréciées et de ce fait estimées par le public de l'UE.

Les éléments de preuve proviennent d'un large éventail de sources secondaires, comprenant notamment la littérature scientifique, des études d'évaluation, une analyse en profondeur du cadre politique ainsi que des informations détaillées provenant de six études de cas conduites en République Tchèque, France, Allemagne, Grèce, Roumanie et au Royaume-Uni.

L'importance du soutien de la biodiversité à travers l'agriculture.

L'importance et la valeur de la biodiversité pour le bien-être des hommes sont de plus en plus reconnues à la fois en Europe et mondialement pour sa valeur intrinsèque et culturelle, ainsi que pour son rôle dans la fourniture de services écosystémiques essentiels. En effet, la préoccupation au sujet de l'environnement en général et de la biodiversité en particulier est largement répandue au sein du public européen.

La Stratégie pour la Biodiversité de l'UE, adoptée en 2011, souligne l'importance du secteur agricole pour atteindre l'objectif prioritaire de biodiversité de l'UE. La Stratégie inclut un objectif spécifique pour « étendre au maximum les zones cultivées dans les prairies, les terres arables et les cultures permanentes couvertes par des mesures de biodiversité au titre de la PAC, afin d'assurer la conservation de la biodiversité et d'améliorer sensiblement l'état de conservation des espèces et des habitats tributaires de l'agriculture ou subissant ses effets, ainsi que la fourniture des services écosystémiques par rapport au niveau de référence fixé par l'UE en 2010, en contribuant ainsi à une gestion plus durable. »

Les terres agricoles représentent environ 40 pour cent de la surface totale de l'UE-27 et leur gestion a des impacts substantiels, à la fois positifs et négatifs, sur le fonctionnement des systèmes naturels. Au fil du temps, l'agriculture a contribué à la création d'une riche diversité d'habitats et de paysages, y compris des habitats semi-naturels à haute valeur de biodiversité. Cependant, dans la seconde moitié du vingtième siècle, des changements structurels dans l'agriculture ont conduit à une plus grande intensification, concentration et spécialisation de la production dans certaines zones et marginalisation et abandon des terres dans d'autres, conduisant à des pertes de biodiversité significatives dans le paysage cultivé. Un certain nombre de facteurs ont encouragé ces tendances, notamment les soutiens au titre de la PAC et des facteurs exogènes tels que les tendances des prix des produits agricoles de base, les changements technologiques, des accords commerciaux et plus récemment le changement climatique. Ces tendances n'ont pas seulement un impact sur la biodiversité du milieu agricole, mais aussi sur la fourniture de plusieurs services écosystémiques, tels que la qualité de l'eau, la santé du sol et la qualité de l'air.

Interactions entre agriculture et biodiversité

La situation de la biodiversité aujourd'hui en Europe est essentiellement le résultat de milliers d'années d'interactions de l'homme avec l'environnement. Au cours de l'expansion de l'agriculture en Europe, un certain nombre de pratiques agricoles traditionnelles de faible intensité, qui étaient adaptées aux différents climats, topographies et sols, se sont développées au fil du temps, créant ainsi une riche diversité de paysages agricoles et de nouveaux habitats. Les nouvelles communautés d'espèces qui sont apparues initialement ont probablement accru la richesse en espèces dans une grande partie de l'Europe. Certains de ces habitats semi-naturels, tels que les pâturages boisés, les prairies de fauche, les terrains broussailleux et les landes, survivent encore aujourd'hui et continuent à être gérés par les agriculteurs et éleveurs pastoraux. Une caractéristique clé de beaucoup de ces habitats est que la succession naturelle est empêchée par le pâturage, le fauchage de l'herbe et dans certaines parties d'Europe, par des pratiques d'écobuage soigneusement contrôlées. L'élevage et les pratiques de faible intensité qui y sont associées y ont joué un rôle important et leur continuation est souvent cruciale pour leur survie. Certains des habitats naturels non-boisés qui se sont développés après la dernière ère glaciaire en Europe, tels que la toundra, les tourbières de couverture, les prairies de montagne et les steppes salées, peuvent aussi être considérés comme des habitats agricoles du fait qu'ils sont en partie pâturés, même s'ils n'en dépendent généralement pas pour leur pérennité.

Cependant, les changements rapides du développement agricole au cours des dernières décennies ont conduit à des gains de productivité significatifs dans les zones les plus fertiles de l'UE à travers des processus d'intensification, de concentration et de spécialisation. Ceci a créé des habitats et paysages agricoles extrêmement modifiés et simplifiés qui sont hostiles à beaucoup de plantes et d'animaux sauvages (par exemple, en conséquence de mises en cultures fréquentes, de l'utilisation de pesticides, de fertilisants et de la présence de cultivars hautement compétitifs) et qui souvent ne fournissent plus de ressources de nourriture suffisantes pour les espèces qui pourraient sinon tolérer les nouvelles conditions.

Un large consensus existe dans la littérature scientifique sur le fait que la majorité des espèces à haute valeur de conservation est associée à des habitats semi-naturels ou naturels. De manière générale, la valeur de biodiversité (considérée comme la diversité des espèces caractéristiques et espèces rares) diminue quand augmentent l'amélioration, la spécialisation, la concentration et l'intensification agricoles et avec les changements dans les pratiques qui y sont associés et qui sont nécessaires à l'augmentation de l'efficacité.

Par conséquent, le facteur clé qui détermine le niveau de biodiversité associé aux habitats agricoles est le degré de modification de ces habitats par rapport à leur état naturel et résultant du pâturage, des améliorations agricoles faites une seule fois ou occasionnellement (c'est-à-dire le drainage, le labourage ou le réensemencement) et /ou d'une intensification systématique ou modernisation de la gestion, comme les mises en culture, l'utilisation de fertilisants, de l'irrigation ou de pesticides etc. Il est important de noter que les systèmes agricoles hautement productifs dans des terres modifiées ou cultivées de façon intensive et les pâturages temporaires continuent de présenter quelques espèces répandues et adaptables, particulièrement des oiseaux, bien qu'ils présentent une faible diversité d'espèces et abritent très peu d'invertébrés, de plantes, d'oiseaux ou d'autre faune de haute importance du point de vue de la conservation. Comme elles sont souvent les derniers vestiges de nature visibles dans de nombreux paysages agricoles, elles sont particulièrement appréciées du grand public et ont par conséquent une grande valeur culturelle.

A travers une analyse des données de suivi spécifiques aux habitats agricoles, cette étude réaffirme les conclusions du rapport de l'AEE sur la Situation de Référence de la Biodiversité Européenne en 2010, selon lesquelles une part particulièrement faible des habitats agricoles est dans un état favorable de conservation. Des données de suivi sur l'état des habitats listés dans l'Annexe 1 de la Directive Habitats démontrent qu'une amélioration considérable de la condition de ces habitats est nécessaire si l'on veut atteindre les objectifs de la Directive Habitats. Des recherches récentes identifient 63 habitats (sur 231 listés en Annexe 1) qui sont, dans une certaine mesure, tributaires de l'agriculture, 25 d'entre eux sont considérés comme totalement tributaires des activités agricoles et sont par conséquent particulièrement sensibles à l'abandon agricole.

Des données de suivi des dernières décennies sur les oiseaux et les papillons fournissent aussi la preuve de déclins substantiels dans les populations des espèces et la richesse des espèces, particulièrement dans les prairies améliorées et les habitats cultivés de façon intensive. De tels déclins sont désormais de plus en plus similaires dans tous les pays de l'UE, bien que les pertes les plus importantes aient eu lieu dans l'UE-15. Les populations d'oiseaux communs des terres agricoles ont ainsi diminué de 20 pour cent depuis 1990 et d'approximativement 50 pour cent depuis 1980, ces tendances d'évolution d'avant 1990 sont toutefois moins avérées. Quelques éléments laissent à penser que le rythme du déclin pourrait s'être stabilisé, mais les espèces rares d'oiseaux des terres agricoles d'une haute importance de conservation (y compris ceux des systèmes céréaliers extensifs et des cultures permanentes) continuent de décliner. Les données sur les papillons semblent indiquer des déclins encore plus marqués, particulièrement parmi les espèces des prairies semi-naturelles. Des données de suivi paneuropéennes sur les plantes et d'autres groupes taxonomiques ne sont pas disponibles mais plusieurs études nationales montrent invariablement de très forts taux de déclin de la diversité des espèces dans les prairies améliorées et les habitats agricoles cultivés de façon intensive.

Comme cadre pour cette étude, une typologie des habitats agricoles a été développée, à l'échelle du champ, en fonction de leur valeur relative en matière de biodiversité qui identifie le type de végétation associé à chaque habitat, le nombre d'habitats et d'espèces prioritaires (tels qu'ils sont classés sous les Directives Oiseaux et Habitats) qui leurs sont associés ainsi que les besoins principaux de gestion pour chaque habitat en matière de pratiques agricoles relativement spécifiques. Cette typologie distingue les prairies permanentes pâturées par du bétail des autres formes de végétation naturelle ou semi-naturelle ; les prairies améliorées ; les terres cultivées, y compris les prairies temporaires ; et les cultures permanentes. Le cadre est aussi utilisé pour illustrer le potentiel de maintien et d'amélioration de la biodiversité par l'agriculture, de même que la gamme de pratiques agricoles qui peuvent soutenir la biodiversité dans chaque type d'habitat particulier.

Le potentiel de maintien et d'amélioration de la biodiversité par les pratiques agricoles varie d'un habitat à l'autre, en fonction principalement de sa valeur de biodiversité. Les habitats naturels ne sont généralement pas tributaires du pâturage et beaucoup sont sensibles au niveau de pâturage. La priorité principale pour ces habitats est donc de garantir que s'ils sont pâturés, ils le soient à un niveau approprié. Par contraste, de nombreux habitats semi-naturels sont fortement dépendants d'une continuation d'un certain nombre de pratiques agricoles bénéfiques (telles que le pâturage extensif par un bétail approprié, la fenaison traditionnelle et l'agroforesterie traditionnelle) qui pourraient disparaître en raison d'une intensification ou d'un abandon. Une gestion agricole extensive peut aussi contribuer à la restauration d'habitats semi-naturels rares et fragmentés, ce qui est une priorité dans certaines régions. Dans les habitats améliorés / intensifs, la priorité est de modifier les pratiques agricoles pour éviter ou réduire à des niveaux acceptables les impacts sur des habitats non-agricoles importants tels que les zones humides (par exemple par l'intermédiaire de bandes tampon pour réduire le ruissellement) ; de maintenir les éléments non-cultivés tels que les haies, les jachères, les taches d'habitats que constituent les fourrés, arbres, fossés et mares, qui servent d'aires d'alimentation et de reproduction et qui aident à créer une connectivité écologique dans des paysages agricoles fragmentés. Les systèmes d'agriculture mixte et l'utilisation de la rotation des cultures (particulièrement avec jachère) au sein des systèmes arables aident aussi à maintenir une diversité à l'échelle du paysage, qui est importante dans les paysages agricoles semi-naturels et exploités plus intensivement.

Les futures tendances de la restructuration agricole sont susceptibles d'avoir des implications mitigées pour la biodiversité et des pertes supplémentaires de biodiversité sont probables. Une intensification accrue exercera vraisemblablement des pressions extrêmes sur les états membres de l'UE-12, parce qu'il y a une marge considérable pour davantage d'investissement, de restructuration et de progrès technologique dans les exploitations de la région. Cela aura des conséquences substantielles sur la biodiversité puisque beaucoup des habitats et espèces agricoles les plus menacés d'Europe demeurent présents dans ces régions, ce qui est principalement le résultat d'une agriculture moins intensive. De plus, on s'attend à ce que des surfaces importantes d'habitats semi-naturels et d'autres terres agricoles de Haute Valeur Naturelle soient particulièrement vulnérables à une gestion nettement réduite et à l'abandon des terres (en particulier dans les zones plus marginales), ce qui aura généralement des effets négatifs lorsque de grandes proportions du paysage seront affectées.

L'efficacité des politiques et mesures promouvant la biodiversité à travers l'agriculture

La PAC est l'instrument de financement le plus important au niveau de l'UE ayant le potentiel de promouvoir la biodiversité associée à l'agriculture à l'échelle européenne, étant donné qu'elle influence la gestion de la majorité des terres agricoles. Le maintien, l'amélioration et la restauration de la biodiversité ont été une des priorités-clés des mesures environnementales au sein de la PAC, depuis qu'elles ont été introduites dans les années 1980-1990, la priorité principale étant sur les mesures visant à influencer les pratiques de gestion des terres. La mesure agro-environnementale continue d'être la plus importante à cet égard, à la fois du point de vue des ressources financières qui lui sont allouées et de sa couverture spatiale. Dans le premier pilier, la conditionnalité est la mesure principale ayant actuellement la biodiversité comme objectif. Cependant, toute une gamme d'autres mesures de la PAC peut aussi être utilisée pour promouvoir la biodiversité, à la fois au sein du premier et du deuxième piliers. La législation environnementale joue évidemment aussi un rôle clé, comme par exemple les exigences des Directives Oiseaux et Habitats, y compris la création du réseau Natura 2000. D'autres législations environnementales de l'UE, telles que la Directive Cadre Eau et la Directive Nitrates peuvent aussi aider à protéger et enrichir la biodiversité agricole, par exemple en réduisant l'utilisation des fertilisants et des pesticides, ce qui aura des répercussions bénéfiques sur les espèces et les habitats.

Alors que de réels progrès ont été faits ces dernières années grâce aux efforts pour inverser les tendances au déclin de la biodiversité agricole dans l'UE, les pressions auxquelles la biodiversité doit faire face sont telles que cela a été insuffisant pour atteindre les objectifs fixés pour 2010. Il y a de nombreuses raisons à cela. Cependant, il est clair que le cadre politique actuel fournit une bonne base sur laquelle s'appuyer pour effectuer les changements requis pour réussir à atteindre, dans les huit prochaines années, les nouveaux objectifs de biodiversité pour 2020 et les objectifs agricoles qui y sont relatifs au titre de la nouvelle Stratégie de la Biodiversité. A cette fin, dans le cadre de la réforme actuelle de la PAC, la Commission propose d'accroître sa contribution à la biodiversité en introduisant dans le premier pilier de nouvelles mesures environnementales obligatoires liées aux paiements directs.

En ce qui concerne la PAC actuelle, les mesures suivantes ont une importance particulière pour l'atteinte des objectifs de biodiversité de la politique :

La mesure agro-environnementale : En tant que seule mesure du deuxième pilier de la PAC dont la mise en œuvre est obligatoire pour les états membres, la mesure agro-environnementale est la principale mesure utilisée pour encourager les exploitants agricoles à adopter des pratiques de gestion qui soient bénéfiques à la biodiversité. L'un des mérites de la mesure est sa flexibilité, qui permet aux états membres de développer des programmes basés sur le volontariat, qui reflètent les différentes conditions biophysiques, climatiques, environnementales et agronomiques de façon à s'adapter aux conditions locales. Un certain nombre d'études scientifiques ont confirmé que globalement, l'état de la biodiversité des habitats agricoles soumis à des mesures agro-environnementales est significativement meilleur que ce qu'il serait si cette politique n'avait pas été en place. Il existe de bonnes preuves que des mesures agro-environnementales bien conçues et bien mises en œuvre ont été essentielles pour le maintien et le rétablissement de la biodiversité dans de nombreuses régions.

Dans les habitats semi-naturels, la mesure agro-environnementale a été utilisée pour des programmes extrêmement ciblés et sur mesure de conservation d'habitats et d'espèces menacés (étant souvent le moyen clé de parvenir à une gestion appropriée dans les sites Natura 2000), ainsi que pour encourager le maintien d'une gestion peu intensive sur les terres agricoles de Haute Valeur Naturelle (HVN) dans le reste du paysage agricole. Il existe de nombreux exemples de programmes agro-environnementaux qui ont réussi à soutenir l'agriculture de HVN, assurant par là même le maintien d'habitats semi-naturels de pâturages boisés (Suède, Estonie), de prairies de fauche et de pâturages de montagne (Slovaquie, Roumanie), de la réhabilitation des prairies sur-pâturées (Bulgarie), du pâturage des landes (RU) et des systèmes traditionnels agro-forestiers en Espagne ("dehesas"). Un soutien à des races locales traditionnelles, soit à travers leur utilisation dans les options de gestion des programmes agro-environnementaux ciblant l'agriculture à HVN, soit par des programmes agro-environnementaux spécifiques pour les ressources génétiques, a été essentiel pour enrayer leur déclin. Les programmes agro-environnementaux ciblant les terres agricoles de HVN n'ont pas été bénéfiques seulement à la biodiversité mais ont aussi fourni toute une gamme d'autres bénéfices environnementaux et soutenu des services écosystémiques. En permettant à de tels systèmes de perdurer, les programmes agro-environnementaux soutiennent indirectement leur contribution continue à l'économie locale, en contribuant à l'emploi et en servant de base à des activités de diversification.

Il est fondamental d'utiliser une combinaison efficace de mesures pour obtenir des résultats durables pour la biodiversité dans les habitats semi-naturels, particulièrement dans les régions en retard sur le plan économique. Par exemple, dans diverses régions, la mesure agro-environnementale a été utilisée en combinaison avec plusieurs autres paiements à la surface du deuxième pilier de la PAC pour atteindre des résultats en matière de biodiversité, par exemple les paiements Natura 2000 et la mesure de compensation pour les « zones défavorisées » (paiements ZD). Il a été démontré que d'autres mesures jouent aussi un rôle important si elles sont utilisées de façon appropriée, par exemple celles qui apportent un soutien à des services aux agriculteurs en matière de conseil, formation, information et vulgarisation ; certains investissements en capital associés à la modernisation des exploitations, aux investissements non-productifs et à la mesure sur les infrastructures ; un soutien aux associations de producteurs pour des produits de qualité ; une diversification dans des activités économiques non-agricoles et l'approche participative LEADER.

Bien que les preuves ne soient pas unanimes, elles suggèrent que les mesures agro-environnementales se sont également avérées être une réussite pour apporter des bénéfices pour des espèces répandues et communes des prairies améliorées et des terres cultivées de façon intensive. Les bénéfices associés à des mesures agro-environnementales pour les terres cultivées de manière intensive sont obtenus essentiellement dans les cas où une combinaison d'options de gestion fournit des ressources écologiques clés aux espèces vulnérables, en particulier un habitat de reproduction et des ressources alimentaires tout au long de l'année, puisqu'elles tendent à être réduites par l'intensification et la spécialisation agricoles. La principale priorité pour la plupart des espèces en déclin de tels habitats (particulièrement les oiseaux) est des mesures qui fournissent des ressources dans les champs (telles que des taches ou des champs en jachère, des chaumes laissés sur place l'hiver, des cultures diverses et des cultures utilisant moins de pesticides). Cependant, certaines espèces bénéficient aussi de mesures de gestion des bordures des champs, telles que la plantation, sur ces bordures, de plantes riches en graines ou en nectar ou la réduction de l'utilisation de pesticides sur les bords des champs. Le maintien des populations d'espèces communes s'est souvent révélé être un plus grand défi du fait de l'échelle requise pour la réponse apportée, mais il y a eu quelques succès et les initiatives récentes sont encourageantes. Une gamme de facteurs affecte les résultats des programmes agro-environnementaux, dont un certain nombre ne sont pas liés à la politique ou à la gestion agricole. Ils comprennent les variations climatiques et météorologiques ; la chasse ou la mise à mort d'espèces à l'intérieur et à l'extérieur de l'Europe ; les espèces exotiques envahissantes ; les prédateurs, y compris les grands carnivores, tels que les ours et les loups ; la perte d'habitat non-agricole à la fois dans et en dehors de l'Europe qui affecte les espèces migratoires ; et une gestion incompatible des terres avoisinantes.

La conditionnalité : Certaines des conditions requises de la conditionnalité, désormais spécifiées dans la PAC, sont importantes pour garantir des niveaux de gestion minimum qui puissent soutenir la biodiversité en milieu agricole. En requérant qu'un certain niveau de gestion soit pratiqué comme condition préalable à la fois à la perception de paiements directs et aux paiements agricoles à la surface au titre du second pilier, la conditionnalité peut aider à limiter les impacts négatifs potentiels à la fois de l'intensification et de la marginalisation des habitats agricoles (par l'intermédiaire des standards des Bonnes Conditions Agricoles et Environnementales – BCAE). Les Exigences Réglementaires en Matière de Gestion (ERMG) aident à renforcer l'application de la législation environnementale. Une évaluation de l'impact de ces mesures sur la biodiversité à un niveau paneuropéen est requise de façon urgente du fait que beaucoup de ces standards ont été modifiés depuis 2005 ou introduits plus récemment et qu'il existe peu d'informations récentes sur lesquelles fonder une évaluation de leur efficacité.

Paiements directs : Les paiements directs ne sont pas eux-mêmes axés directement sur la fourniture de biodiversité. Cependant, ils constituent le fondement des exigences de la conditionnalité et en résultat de ce lien, les paiements directs peuvent influencer la sensibilisation et le comportement des agriculteurs par rapport à certaines préoccupations au sujet de la biodiversité. Ils jouent un rôle dans la stabilisation des revenus des exploitations, ce qui est, dans ce contexte, particulièrement important pour les exploitations qui sont économiquement vulnérables et qui gèrent des terres qui sont importantes pour la biodiversité. En tant que tels, ils fournissent une base pour des mesures plus ciblées sous le second pilier. Il est possible pour le futur d'orienter ces paiements pour qu'ils ciblent davantage des objectifs environnementaux, comme le propose la Commission.

Certaines questions d'éligibilité relatives à la mise en œuvre de paiements directs ont involontairement conduit, dans certains états membres, à des atteintes localement spécifiques à la biodiversité. Les agriculteurs risquant réellement de ne plus bénéficier des paiements directs lorsque leurs terres ne respectent pas les règles d'éligibilité appliquées au niveau national ou certaines dispositions des BCAE, ils sont fortement motivés pour changer la gestion de leurs terres pour minimiser ce risque. Dans certains cas, lorsque des questions de conditionnalité ou d'éligibilité ne sont pas claires ou mal interprétées, des agriculteurs ont éliminé la végétation dans des habitats semi-naturels de peur d'être pénalisés. Dans d'autres cas, des habitats bénéfiques à l'environnement ont été jugés inéligibles pour des paiements directs dans des régions particulières, ce qui augmente le risque de l'arrêt à terme de l'exploitation agricole de terres et de leur abandon. Par conséquent, les grandes superficies de terres qui, pour diverses raisons, ne sont pas actuellement déclarées ou éligibles pour des paiements directs sont sujets d'inquiétude générale ; elles comprennent certains des pâturages permanents les plus extensifs et ayant le plus de valeur écologique, notamment ceux listés sous les Directives Oiseaux et Habitats en Estonie, Bulgarie, Roumanie, Slovaquie, Suède, Espagne, Ecosse, Irlande du Nord et France (alpages).

Plus généralement, il est nécessaire de développer une réponse politique cohérente à la biodiversité des terres agricoles, dans laquelle les mesures agissent en synergie et les effets pervers sont évités. En particulier, le développement de combinaisons appropriées de mesures génériques largement mises en œuvre et de mesures plus ciblées et sur mesure est essentiel pour que toutes les politiques aient les impacts écologiques souhaités. Cependant, les mesures doivent aussi être suffisamment accessibles et attractives pour les agriculteurs pour garantir des niveaux adéquats d'adhésion. Par conséquent la fourniture de conseils et d'informations, parallèlement à la formation et au développement des compétences se sont aussi révélés, dans de nombreuses régions, être un facteur clé influençant la mise en œuvre réussie de mesures de politique visant à obtenir des résultats en matière de biodiversité. Ceci est valable aussi bien pour les mesures fondées sur le volontariat, telles que les programmes agro-environnementaux, que pour les exigences réglementaires et les standards des BCAE. Il a aussi été démontré que certains facteurs institutionnels et de gouvernance sont importants pour aider à optimiser la conception et la mise en pratique réussies des mesures de politique.

Ils incluent la présence, au sein des autorités publiques, de ressources administratives et techniques et d'expertise adéquates, notamment d'un personnel formé de façon appropriée qui comprend les interactions dynamiques entre agriculture et environnement. Des bases de données adéquates et des systèmes appropriés doivent être en place pour permettre de bien cibler les mesures et d'en assurer le suivi, d'effectuer efficacement les paiements et d'assurer un contrôle et une mise en application efficaces. Enfin, il est important de reconnaître que les mesures de la PAC n'opèrent pas isolément. Elles interagissent avec une gamme d'autres politiques. L'utilisation de mesures axées sur la biodiversité dans la PAC doit par conséquent être reconnue comme une part intégrante des stratégies de biodiversité nationales plus larges, qui identifient la gamme d'instruments de politique qui doivent être utilisés pour atteindre les objectifs de biodiversité.

La biodiversité dans une perspective de durabilité

Le contexte économique, politique et environnemental dans lequel opèrent les mesures promouvant les pratiques de gestion des terres favorables à la biodiversité n'est pas statique et est influencé par une large gamme de facteurs liés ou non aux politiques. En effet, les objectifs de biodiversité de l'Europe doivent être atteints tout en traitant simultanément les priorités pour la viabilité économique, sociale et environnementale plus globale des zones rurales, y compris en abordant des nouveaux défis tels que le changement climatique.

Différentes tendances du développement des économies et communautés rurales exercent des pressions diverses sur la biodiversité. Dans le passé, les politiques stimulant la croissance économique des zones rurales ont souvent mal pris en compte la biodiversité et des dommages en ont résulté. Quand on considère les relations entre la biodiversité et les objectifs des politiques pour le développement socio-économique des zones rurales, pour garantir la viabilité et la compétitivité du secteur agricole et pour atteindre les objectifs en matière de climat, il existe des opportunités claires pour utiliser la biodiversité comme un atout économique, comme partie intégrante de la solution pour parvenir à un développement durable des zones rurales.

En particulier, l'objectif de « croissance verte » dans la stratégie Europe 2020 pourrait offrir des opportunités pour la biodiversité à la fois à travers le développement de technologies vertes qui peuvent limiter l'impact de l'agriculture sur l'environnement, et aussi à travers des initiatives économiques plus larges, par exemple à travers le tourisme durable et des activités de gestion de la biodiversité dans les exploitations, etc. Une protection adéquate de la biodiversité est également essentielle à la fourniture de nombreux services écosystémiques qui sont nécessaires pour sous-tendre les activités économiques. Plus fondamentalement peut-être, la biodiversité, particulièrement en ce qui concerne la santé des sols, est également cruciale pour la productivité et la durabilité à long terme de l'agriculture et elle jouera donc un rôle clé pour garantir la sécurité alimentaire dans le futur.

Cependant la mesure dans laquelle ces synergies pourront être utilisées comme partie intégrante des futures trajectoires du développement des zones rurales variera en Europe.

Une typologie des zones rurales est utilisée pour aider à distinguer les différentes opportunités, synergies et conflits qui pourraient apparaître et la façon de les exploiter au mieux ou de les éviter dans les différents cas de figure. Ceci montre que les zones qui accusent un retard économique sont particulièrement préoccupantes, par exemple les zones où l'agriculture reste à petite échelle, non-modernisée et qui souffrent de l'isolement et d'un déclin de leurs populations. Dans ces régions, une pression particulière pèse sur les économies rurales pour qu'elles se développent et deviennent plus compétitives alors même que les conséquences pour la biodiversité peuvent être particulièrement délicates. Il est primordial de trouver des moyens d'arriver à des solutions durables pour ces régions. En effet, la viabilité à long terme (économique et sociale aussi bien qu'environnementale) des voies que peut emprunter le développement rural est une préoccupation clé pour la biodiversité, et la politique publique, y compris la politique de développement rural de la PAC, joue un rôle clé dans le soutien de cette viabilité.

Des opportunités existent bel et bien. Par exemple, l'agriculture peut être « intégrée » dans une économie et une communauté régionales plus larges de façons qui renforcent la valeur économique directe de la biodiversité en tant qu'élément des systèmes et pratiques agricoles, comme c'est le cas pour l'agriculture biologique, les produits à haute valeur ajoutée liés aux pratiques agricoles qui protègent la biodiversité de façon concrète, l'éco-tourisme ou le développement de loisirs à faible impact et durables qui glorifient et protègent la biodiversité.

L'existence de situations « gagnant-gagnant » où la biodiversité est soutenue par le développement rural durable dépend, dans une certaine mesure, de la nature et de l'importance des services écosystémiques de valeur associés à la biodiversité des terres agricoles. Cependant, cela requiert également des éléments de capital humain et social sous forme d'une forte sensibilisation à l'environnement et d'un fort soutien culturel à la biodiversité, d'une capacité institutionnelle significative, de façon à concevoir et gérer des solutions ainsi que des liens forts entre la protection du patrimoine naturel et l'activité économique rurale. L'existence d'une combinaison de facteurs de politiques et extérieurs à la politique, qui sont capables de maintenir un certain niveau d'équilibre et de stabilité dans le paysage agricole (comprenant les exploitations et les communautés agricoles et leurs compétences et connaissances) pour des habitats agricoles relativement variés sur le plan de la biodiversité, gérés par l'intermédiaire de pratiques agricoles anciennes, est effectivement importante. Ces facteurs doivent être développés là où ils n'existent pas à l'heure actuelle.

Il existe de nombreuses preuves suggérant qu'il est bien plus probable que la protection et l'amélioration de la biodiversité aient lieu lorsque les agriculteurs sont fortement sensibilisés aux implications environnementales de leurs pratiques de gestion, qu'il y a une bonne coopération entre les différents services gouvernementaux et les parties prenantes et que les institutions sont bien informées sur la biodiversité, sa valeur pour le développement économique et ses besoins. Au contraire, des éléments de preuve indiquent qu'un manque de capacité institutionnelle et /ou de sensibilisation des agriculteurs peut créer des barrières significatives à l'adoption et la mise en œuvre efficaces de politiques et pratiques respectueuses de la biodiversité. En substance, une meilleure compréhension entre les bénéficiaires des politiques et les décideurs / administrateurs politiques favorisera la conservation de la biodiversité et contribuera à renforcer les synergies et éviter les conflits lorsque les politiques sont conçues et mises en œuvre à travers des approches répondant aux besoins locaux et fondées sur le partenariat.

Parvenir à la conservation de la biodiversité par l'agriculture comme perspective stratégique

La promotion de la biodiversité et la fourniture de services écosystémiques par le secteur agricole ne peuvent être appréhendées séparément de la réalisation d'autres objectifs environnementaux, sociaux et économiques. Par conséquent, même si la PAC continuera à jouer un rôle central, le contexte plus général est également crucial.

Trouver le bon équilibre entre la fourniture par les terres agricoles de services écosystémiques « non-productifs », tels que la qualité de l'eau, la pollinisation, des paysages appréciés et bien sûr la biodiversité elle-même, et la création de conditions favorables pour produire des récoltes, du bétail et de l'énergie est un défi à relever pour assurer une gestion durable des terres sur le long terme. Une partie intégrante de ce défi consistera à traiter de manière relativement urgente les questions relatives à l'utilisation des terres pour les biocarburants et le déploiement de nouvelles technologies.

Par conséquent, une approche intégrée est requise, qui puisse identifier des opportunités « gagnant-gagnant » partout où elles sont possibles, tout en reconnaissant l'importance des conflits potentiels et des compromis qu'on pourrait avoir à faire. Les solutions sur le terrain varieront dans les différentes régions de l'UE-27, en fonction des conditions locales. Certaines nécessiteront le maintien des systèmes agricoles et des pratiques de gestion des terres existants, tandis que d'autres requerront que des changements soient faits, en particulier dans les systèmes agricoles plus intensifs. Dans certains cas, seront requises des mesures de politique complètement sur-mesure et extrêmement ciblées, qui soient axées sur les besoins de gestion spécifiques d'une espèce ou d'un habitat particuliers dans un site particulier. Dans d'autres situations, quelques simples exigences pouvant être appliquées sur l'ensemble du paysage agricole seront nécessaires. Une stratégie complète impliquant la PAC doit aussi traiter la question sous-jacente de la viabilité des systèmes et structures agricoles, particulièrement lorsqu'ils sont fortement liés à la promotion de la biodiversité. De plus en plus, des innovations dans les méthodes de production et /ou les pratiques de gestion seront nécessaires de façon à trouver des moyens d'accroître la production alimentaire sur le long terme sans porter atteinte à l'environnement et à la biodiversité. Afin de répondre à ces priorités, un éventail de mesures est requis au sein de la PAC, allant du très particulier au plus général.

Parmi les mesures de politiques actuellement disponibles, la plus bénéfique pour la biodiversité est la mesure agro-environnementale. Cette mesure est particulièrement flexible et peut être adaptée pour obtenir, dans tout l'espace cultivé, aussi bien des activités ciblées et sur mesure que des ajustements de gestion plus simples. Comme une gestion continue et appropriée sur un certain nombre d'années est souvent importante pour obtenir des bénéfices pour la biodiversité, une mesure qui peut fournir de telles conditions sur une période de temps spécifié et longue est particulièrement précieuse. La nature contractuelle de l'accord est donc importante ; elle fournit un cadre stipulant clairement les exigences, le calendrier envisagé et le paiement qui devra être effectué. Comme il lie mutuellement les parties, il garantit aussi un engagement soutenu de l'agriculteur, qui a la certitude de recevoir le paiement correspondant, après mise en conformité.

Cependant, le fait que les programmes agro-environnementaux reposent sur le volontariat, combiné à un financement disponible limité au titre du second pilier, signifie qu'il y a des limites à ce qui peut être obtenu pour la biodiversité par cette seule mesure. Les propositions législatives pour la réforme de la PAC à partir de 2014 ont suggéré l'introduction de paiements annuels généralisés dans le premier pilier, pour « les pratiques agricoles bénéfiques pour le climat et l'environnement » qui seront obligatoires. Ils sont liés aux paiements directs, comme un moyen d'obtenir des bénéfices plus importants pour la biodiversité dans tout l'espace cultivé, particulièrement pour les espèces communes et répandues (COM (2011) 625/3). Ces propositions représentent un bouleversement important dans la composition des paiements directs, avec la proposition d'allouer une proportion importante (30 pour cent) des paiements directs aux paiements pour la fourniture de bénéfices environnementaux, et du fait que les mesures ont une très large couverture.

Identifier des pratiques de gestion annuelles uniques applicables à tous, qui peuvent fournir des bénéfices environnementaux significatifs, n'est pas simple, car les exigences écologiques sont généralement spécifiques au contexte. Malgré tout, trois mesures ont été proposées qui pourraient être mises en œuvre sur cette base – les surfaces d'intérêt écologique, le maintien des prairies permanentes et la diversité des cultures. Parmi les propositions, la mesure qui a peut-être le plus fort potentiel pour fournir un bénéfice environnemental supplémentaire est celle des « surfaces d'intérêt écologique », qui exige qu'une proportion (7 pour cent sont proposés) des hectares éligibles d'une exploitation (à l'exclusion des terres sous forme de prairies permanentes) soit allouée à des fins écologiques, par exemple comme éléments du paysage, zones tampon ou jachères. Ceci a sans aucun doute le potentiel de fournir des bénéfices importants en matière de biodiversité, tels que pour les oiseaux, les mammifères et les invertébrés ainsi que des bénéfices pour la biodiversité aquatique, résultant d'une réduction du ruissellement et de la pollution des cours d'eau. Cependant, leur magnitude réelle dépendra des détails précis de cette mesure, qui ne sont pas encore clairs. De plus, les bénéfices pour la biodiversité pourraient être significativement accrus en ciblant et en adaptant de façon appropriée les pratiques de gestion sur les terres concernées, ce qui, dans de nombreux cas, peut être obtenu à travers l'utilisation des accords agro-environnementaux.

Exiger le maintien, au niveau des exploitations, des pâturages permanents devrait aussi fournir certains bénéfices en matière de biodiversité. Les impacts les plus répandus concerneraient la limitation de la conversion des prairies améliorées en prairies temporaires et en cultures arables (par exemple, maïs), avec à la clé des bénéfices pour la condition du sol et la biodiversité et des bénéfices induits en amont de la chaîne alimentaire ainsi que pour la biodiversité aquatique. La conversion des prairies semi-naturelles, qui sont à particulièrement haute valeur de biodiversité, en prairies temporaires ou cultures arables serait aussi restreinte, cependant on devra continuer à prendre en compte les risques d'amélioration agricole et d'abandon auxquels ces prairies font face, par l'intermédiaire d'autres mesures telles que la mesure agro-environnementale. De plus, l'utilisation de 2014 comme année de référence pour la surface de pâturages permanents qui doit être maintenue pourrait constituer une incitation pour les agriculteurs pour convertir des prairies permanentes dans l'intervalle. Comme mesure transitoire, la Commission a proposé de prolonger de quelques années l'actuelle conditionnalité nationale sur les pâturages permanents.

L'introduction de plus de diversité dans les modèles de cultures, particulièrement là où les monocultures à grande échelle prédominent aujourd'hui, a le potentiel d'apporter des bénéfices modestes à la biodiversité. Il y a cependant peu d'éléments de preuve sur ce que les impacts précis risquent d'être pour la biodiversité, bien qu'il soit probable qu'ils bénéficient plus aux espèces communes et répandues du fait des améliorations de la biodiversité des sols et des populations globales d'invertébrés. Cependant, comme avec n'importe quelle mesure sur la biodiversité, les impacts seront spécifiques au contexte.

Les mesures «d'écologisation » ne doivent pas être considérées en isolation. Elles devraient fournir une large fondation sur laquelle des programmes agro-environnementaux plus focalisés, dans le cadre du deuxième pilier, pourront s'appuyer. Les états membres auront alors la flexibilité d'utiliser la part du budget actuellement allouée à la mesure agro-environnementale pour rendre incitatives des activités de gestion plus adaptées et ciblées, ce qui est important.

Le potentiel environnemental des mesures plus générales peut être optimisé par une conception appropriée de règles détaillées, suivie d'une mise en œuvre fine et diligente sur le terrain et d'un suivi des impacts pour identifier les ajustements nécessaires. L'existence d'un ensemble adapté de mesures de l'UE au sein des règlements de la PAC n'est donc qu'un premier pas. Ultérieurement, une conception plus détaillée et une mise en œuvre des mesures au niveau des états membres ou au niveau régional sont essentielles, en utilisant une combinaison d'approches générales et plus ciblées, pour répondre efficacement aux besoins locaux en matière de biodiversité.

Quelles que soient les approches de la politique utilisées et dans quelque combinaison que ce soit, un financement adéquat est essentiel. De plus, un certain nombre d'autres principes communs doivent être inclus dans l'architecture de la politique pour garantir des résultats efficaces pour la biodiversité. Ceux-ci comprennent :

- le besoin d'objectifs stratégiques clairs pour énoncer les priorités clés de la politique (ou des politiques) en question, en fournissant un cadre dans lequel des mesures de politique plus détaillées peuvent être établies et pour garantir une cohérence entre les différents éléments de la politique ;
- le fait que la politique soit conçue pour laisser suffisamment d'éléments à la discrétion des états membres pour leur permettre d'utiliser des mesures dans les combinaisons les plus appropriées et de concevoir des réponses politiques qui soient spécifiques régionalement pour répondre aux priorités et besoins identifiés localement ;
- des mécanismes pour obtenir des bénéfices cumulatifs sur plusieurs années et permettre la réalisation d'objectifs à plus long terme, comme la restauration d'habitats ;

- et un suivi et une évaluation sérieux.

La capacité institutionnelle est un facteur limitant important pour l'obtention efficace de résultats en matière de biodiversité à travers l'agriculture et traiter cette question est considéré comme une priorité clé.

Bien que la PAC présente un important potentiel pour contribuer à des résultats en matière de biodiversité dans le milieu agricole, l'atteinte des objectifs de biodiversité associés à l'agriculture ne peut être envisagée en isolation de facteurs complètement extérieurs à la politique, d'autres politiques spécifiquement axées sur la biodiversité et les habitats (par exemple les Directives Oiseaux et Habitats, le programme LIFE+ et la mise en œuvre du réseau Natura 2000) et de politiques locales spécifiques, telles que l'aménagement du territoire, même si les objectifs de biodiversité ne sont pas leur principal objectif. Atteindre les objectifs de biodiversité par la PAC pourrait devenir plus difficile ou plus coûteux si les autres processus politiques tirent dans des directions différentes et si la valeur de la biodiversité pour la société n'est pas complètement reconnue.

En ce qui concerne l'utilisation des terres agricoles et la biodiversité, une question clé est la compétition accrue pour les terres pour différents usages. Au cours de la prochaine décennie, une augmentation des demandes sur les terres comme base de la production agricole risque d'accroître encore les pressions sur la fourniture de services environnementaux, y compris la biodiversité. La biodiversité étant soumise à une pression croissante, une intervention publique est justifiée pour traiter la question du sous-approvisionnement en ces biens publics.

Parallèlement aux mesures au sein de la PAC, l'intégration d'objectifs de biodiversité au sein des mesures d'autres fonds et politiques de l'UE aidera à exploiter au mieux les synergies et permettra que la biodiversité soit perçue comme un composant de l'atteinte des objectifs d'autres politiques de l'UE et nationales. Bien que la biodiversité ne figure pas de façon forte dans la stratégie UE 2020, la feuille de route pour une Europe efficace dans l'utilisation des ressources, publiée récemment, poussant plus loin l'objectif de croissance durable de la stratégie UE2020, met une emphase considérable sur la biodiversité, plaçant la biodiversité et les services écosystémiques proches du cœur de sa vision pour 2050. Les propositions législatives pour la nouvelle PAC visent à intégrer ces principes dans le soutien futur au secteur agricole et aux zones rurales, en soutenant l'emploi et la croissance, promouvant l'innovation et renforçant « la compétitivité à la fois économique et écologique » de l'agriculture.

Conclusions

Un changement majeur est nécessaire pour pouvoir atteindre les nouveaux objectifs de biodiversité de l'agriculture pour 2020 et ceci nécessite des actions sur plusieurs fronts différents. De toutes les politiques de financement de l'UE, la PAC a le plus fort potentiel pour promouvoir la biodiversité en milieu agricole et ses liens avec la Stratégie pour la Biodiversité sont d'une importance clé pour réaliser les objectifs de l'UE 2020 pour la biodiversité. Pour réaliser ce changement majeur, certaines questions non-résolues requièrent l'attention des décideurs politiques à différents niveaux de gouvernance :

- Premièrement, l'échelle spatiale sur laquelle la biodiversité agricole est encouragée doit être augmentée significativement et l'efficience et l'efficacité des mesures améliorées pour garantir que la biodiversité prospère aussi bien dans les zones rurales que dans les zones protégées.
- Deuxièmement, le cadre législatif actuellement en place pour protéger la biodiversité qui présente le plus de valeur en Europe doit être complètement mis en œuvre et respecté adéquatement pour fournir une base saine sur laquelle d'autres mesures de politique pourront construire.
- Troisièmement, un financement public suffisant doit être disponible pour soutenir l'obtention de biodiversité sur les terres agricoles, au-delà ce qui est requis par la loi. Des estimations du niveau de financement requis indiquent que des augmentations significatives sont nécessaires par rapport aux montants actuellement disponibles. Des fonds provenant des deux piliers de la PAC seront la source principale de financement et des mécanismes appropriés sont nécessaires pour guider les dépenses des états membres dans cette direction. Les dépenses au titre de la PAC, qu'elles soient des paiements verts du premier pilier ou des plans de développement rural du FEADER, doivent être reliées aux plans au niveau national pour atteindre les objectifs de biodiversité.
- Quatrièmement, le rapport souligne l'importance de l'utilisation de combinaisons de mesures pour fournir des dispositifs intégrés de soutien aux agriculteurs. Un programme équilibré de mesures combinerait celles qui concernent la gestion agro-environnementale avec celles conçues pour soutenir les investissements en capital dans les exploitations et les zones rurales, des mesures pour obtenir la viabilité économique des exploitations et des zones rurales (par exemple, accès aux marchés, diversification, création de micro-entreprises, encouragement du tourisme rural et conservation du patrimoine rural) et des mesures pour développer les compétences et les capacités des agriculteurs (par exemple, des services de vulgarisation, la fourniture d'information, de conseil et de formation). Une plus grande emphase devrait être mise sur le développement de ces paquets et il y a beaucoup à gagner à les utiliser plus systématiquement. De plus, à la lumière des propositions pour la réforme de la PAC, il sera crucial que les états membres conçoivent et orientent les mesures du deuxième pilier de façon qu'elles s'appuient sur les exigences d'écologisation du premier pilier.
- Enfin le rôle de l'innovation pour favoriser la gestion durable des terres doit être encouragé pour permettre que toute augmentation de la production agricole soit réalisée de manière durable, en tenant compte des besoins en matière de biodiversité et de la fourniture de toute la gamme des services écosystémiques.

1 INTRODUCTION AND PURPOSE OF THE STUDY

1.1 Framing the Study

The importance and value of biodiversity for human well-being is recognised increasingly both in Europe and globally, both in terms of its intrinsic and cultural value as well as the role it plays in providing essential ecosystem services. Indeed, amongst the European public, there is widespread concern for the environment, and biodiversity in particular, as expressed through Eurobarometer surveys, membership of environmental NGOs and pressure groups.

The study uses the widely accepted definition of biodiversity, as set out by the Convention on Biological Diversity (CBD): '*biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'*. Biodiversity, therefore, is understood as relating not just to species, but also to genetic diversity, habitats and ecosystems. The EU's headline target of halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible, also concerns all these components. Furthermore, it is important to note that biodiversity conservation does not just focus on rare and threatened species and habitats listed in the Birds and Habitats Directives. The maintenance of populations of widespread and common species, including those of agriculture habitats is also a serious concern. Such species may not necessarily be protected by EU legislation, but underpin some ecosystem services, are regularly encountered, enjoyed and therefore valued by the EU public.

Although some progress has been made towards halting biodiversity loss in Europe the status of most species and habitats still gives rise to concern (EEA, 2009a). Biodiversity, therefore remains a political priority and the importance of protecting and enhancing biodiversity is formally recognised through high level agreements and targets, including those of the Convention on Biodiversity (CBD) (to which the EU is a signatory), and the EU's own targets. Having failed to meet the 2010 target, in May 2011 a new and more demanding headline target has been set for the EU, '*to halt the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, restore them in so far as feasible, while stepping up the EU contribution to averting global biodiversity loss*'. This is accompanied by the 2050 vision for '*protecting, valuing and restoring EU biodiversity and ecosystem services*'. The new EU Biodiversity Strategy sets out how the new headline target can be met in practice.

Agriculture has had, and continues to have, a very important influence on the state of biodiversity in Europe both now and in the future. Covering about 40 per cent of the total of the land area of the EU-27, the management practices needed to achieve its primary purpose – the production of materials for food, fibre and fuel – have impacts, both positive and negative, on the functioning of natural systems and the availability of natural resources.

Agriculture has been practiced in Europe for millennia, modifying the natural environment to the extent that there is little remaining natural habitat. However the introduction of grazing and cultivation has been accompanied by the creation of a rich diversity of semi-natural habitats and landscapes. As agricultural production methods have developed over time, however, this has led to increased concentration and specialisation of production in some areas and marginalisation and abandonment in others, leading to significant biodiversity losses across the farmed landscape. A number of drivers have encouraged these trends, including support under specific policies, such as the Common Agricultural Policy as well as exogenous drivers such as commodity prices, technological developments, trade agreements, and more recently climate change. These trends do not just impact upon biodiversity on farmland. By impacting on the provision of other ecosystem services, such as water quality or air quality, biodiversity in the wider environment is also affected.

Whilst continuing changes are expected to take place in response to trade liberalisation and increasing global competition, it is unlikely that the competing objectives of economic growth and environmental integration in agricultural policy measures targeted at rural areas are going to be entirely reconciled in near future, even if win-win opportunities are deliberately sought and promoted through EU and national policies. The collectivity of agricultural practices in Europe, interacting with natural conditions will continue to play an important role in determining the state of biodiversity in the EU-27.

As a number of practices favourable to maintaining biodiversity affected by agricultural management cease to be used, the complementary relationship between the management of the land and farmland biodiversity that has developed over centuries is undermined to a considerable degree. 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, for example to ensure adequate feeding, breeding and nesting sites for a majority of farmland species and to promote ecological connectivity. This requires a deliberate allocation of the factors of production on the part of farmers, with consequences for production levels, farm incomes and, in some cases, the flexibility to choose the agronomically most productive form of management. As such, the maintenance and enhancement of farmland biodiversity is increasingly dependent on public intervention of one form or another. Today, this is largely achieved through a combination of regulation, conditions, payments and advice provision through various components of the Common Agricultural Policy, as well as a plethora of other national and regional initiatives.

The EU Biodiversity Strategy stresses the importance of the agricultural sector in meeting the EU's biodiversity targets, including a specific objective to 'maximise areas under agriculture across grasslands, arable land and permanent crops that are covered by biodiversity-related measures under the CAP so as to ensure the conservation of biodiversity and to bring about a measurable improvement in the conservation status of species and habitats that depend on or are affected by agriculture and in the provision of ecosystem services as compared to the EU 2010 Baseline, thus contributing to enhance sustainable management'.

However, achieving the goals set out in the EU Biodiversity Strategy cannot take place in isolation from the other goals and challenges for rural areas. In many parts of Europe, particularly those regions that are lagging in economic terms, increasing the competitiveness of rural economies more generally as well as the agricultural sector is a key priority. In addition to this there are increasing challenges relating to climate change and resource efficiency to address. Sustainable farming practices can facilitate the process of adaptation of rural areas and agriculture to such changes in natural and economic environments. From a perspective of sustainable development, beyond the intrinsic value of biodiversity and habitats to society, a range of social and economic benefits may occur in rural areas from preservation and enhancement of biodiversity. One of the key challenges for biodiversity, therefore, is how to ensure that adequate account is taken of agriculture's role in delivering biodiversity priorities and needs in meeting the EU's strategic objectives, set out within the EU2020 Strategy.

1.2 Purpose and structure of the report

The purpose of this study is consider how policies have worked in terms of their design, coordination and implementation for sustaining biodiversity and associated ecosystem services through agriculture, and how their role can be enhanced in the future to contribute towards meeting the EU's biodiversity goals. Based on a thorough review of the relationship between agricultural management and biodiversity, the study considers the impact, effectiveness and adequacy of the current policies that are in place for biodiversity in relation to the farmed countryside, with the main focus being on those measures within the CAP. Given the economic challenges facing many rural areas, particularly those in those regions of Europe that are economically lagging, the study also considers the challenges for achieving economic development, increased levels of competitiveness and innovation, alongside maintaining high levels of biodiversity. However, reversing declines in biodiversity is not the only environmental challenge that Europe faces over the coming decades. The study also considers how the EU's biodiversity goals can be achieved alongside those for climate change and resource efficiency to find solutions for how biodiversity associated with agriculture might be provided more effectively in the future alongside all the other challenges that need addressing.

The scope of the study is the EU-27 and it is based on a review of pan-European literature as well as evidence from six case studies (Czech Republic, France, Germany, Greece Romania, and the UK). The focus of the study is on biodiversity associated with the management of agricultural land only and therefore forestry management is not within the scope of the study.

The study centres around four themes as set out below.

The interactions between agriculture and biodiversity are set out in Chapter 2. This chapter first looks at the development of agricultural habitats over time, develops an agricultural habitat typology and examines the relationship between different agricultural management practices and the ecological needs of species and habitats. It sets out the biodiversity value of the different types of agricultural habitat (in terms of their importance and potential for biodiversity conservation[1] objectives and some key ecosystem services), and considers the drivers and recent trends, both agricultural and non-agricultural, that impact on agricultural management practices and hence their associated habitats and species. Available monitoring data and published studies are assessed to establish recent trends in agricultural biodiversity in Europe, and the chapter concludes with an assessment (drawing on commissioned modelling work for this study) of the potential impacts of further agricultural change on biodiversity in the future. These findings are taken into account through the rest of the report in identification of CAP measures that can contribute to the achievement of biodiversity conservation objectives in the EU, their effectiveness and necessary strategic and practical developments.

The study proceeds to examine the **impact and effectiveness of policy measures promoting the delivery of biodiversity through agriculture** as well as the reasons for this. This is set out in Chapters 3 and 4. Chapter 3 sets out the range of policy measures, both within and outside the CAP that have the potential to have a positive impact on achieving biodiversity goals associated with agriculture. Then it considers the impact and effectiveness of these policy measures in delivering biodiversity objectives, investigating how the key policy measures influence the management needed for the different agricultural habitats identified in Chapter 2 and how different management options impact a range of species (birds, insects, small mammals, plants) and habitats. The main focus of this analysis is the CAP, although the role of legislation is also considered. Chapter 4 then looks at what the main factors are that contribute to the achievement of successful outcomes for biodiversity, and where there are issues with delivery, what the main reasons for this are reported to be.

Achieving biodiversity goals through agriculture within a sustainability perspective is the focus of Chapter 5. This chapter takes a step back from the policy responses needed to encourage the conservation of biodiversity and ecosystem services at the farm level to consider how biodiversity goals can be met at the same time as meeting the goals of economic development in rural areas. A particular emphasis is placed on the issues within economically lagging regions of the EU. The chapter considers the relationship between biodiversity and the policy objectives for the socio-economic development of rural areas, for ensuring the viability and competitiveness of the agricultural sector and for achieving climate goals. It looks particularly at the issue of whether biodiversity is viewed as an economic constraint or an economic asset. These relationships vary in different areas of the EU-27 depending on a range of factors. A typology of rural areas is therefore developed to help distinguish between the different opportunities, synergies and conflicts that may occur and how these might be maximised or prevented in different situations.

The penultimate chapter of the study considers how to achieve **biodiversity conservation through agriculture as a strategic priority.** Delivering biodiversity and ecosystem services through the agricultural sector cannot be seen in isolation from the delivery of other environmental, social or economic objectives. The chapter highlights that although the CAP

[1] Conservation refers to the maintenance of biodiversity (and restoration where this is necessary to maintain its viability), in accordance with agreed objectives that may be potentially dynamic, through a variety of potential means. It is not therefore analogous to protection, or preservation, which implies the maintenance of the *status quo*.

will continue to play a central role in achieving biodiversity goals, the way in which the strategic priorities for achieving biodiversity conservation through agriculture interact with other EU strategic objectives and policies for climate, renewable energy, resource efficiency, green growth and territorial cohesion, is also critical. The chapter considers the nature of the CAP instruments needed to deliver the strategic priorities related to the protection of agricultural related biodiversity and ecosystem services in order to contribute to meeting the EU's 2020 biodiversity target and sub targets.

Finally a series of **conclusions and recommendations** are offered in Chapter 7 based on the analysis of all four themes.

2 THE INTERACTIONS BETWEEN AGRICULTURE AND BIODIVERSITY IN EUROPE

This chapter focusses on the interactions between agriculture and biodiversity.. It firstly, considers the historical and current relationship between biodiversity and farming practices, and assesses the biodiversity value of the main types of agricultural habitat. It then reviews the drivers of change in agricultural management practices and examines their impacts on habitats and species in the EU. Finally, it assesses the potential impacts of further agricultural change on biodiversity.

2.1 The development of agricultural habitats

2.1.1 Forms of agriculture and field-scale habitats

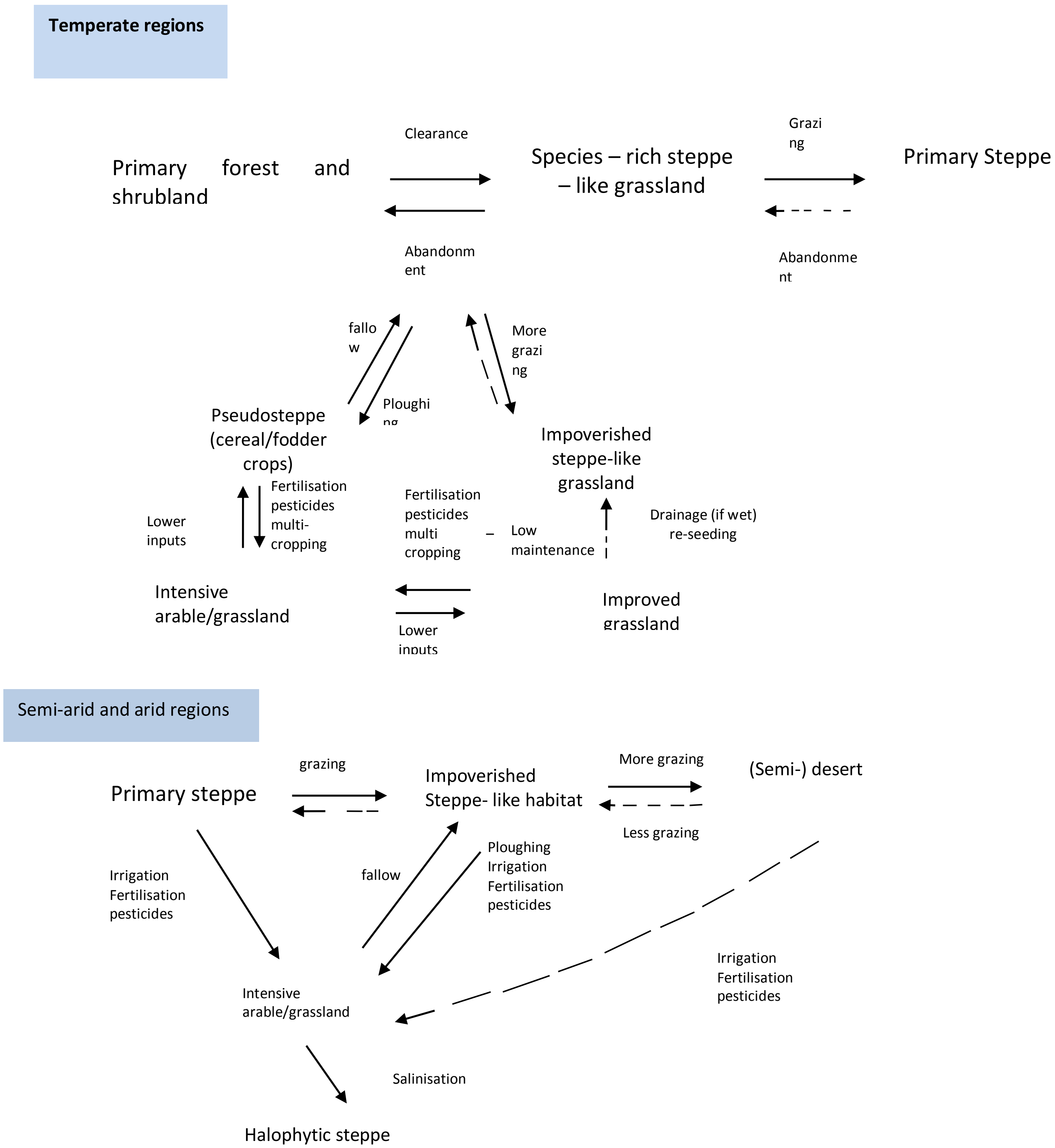
To understand the relative biodiversity value of agricultural habitats and their associated species, and establish appropriate conservation priorities, it is necessary to consider their historical origins and relationships with natural habitats. This is because the habitats that we now have in Europe are primarily a result of thousands of years of human interactions with natural ecosystems. Despite this long period of human influence, some agricultural habitats can be considered to be natural habitats. These are some of the remaining natural non-forested habitats that developed after the last ice-age in Europe, such as tundra, blanket bogs, montane grasslands and salt-steppes. Many of these were originally grazed by wild herbivores, and some are now extensively grazed by domestic livestock. However, the extreme conditions in such habitats prevents abundant tree-growth, and therefore although when grazed they are to some extent agricultural habitats they can be considered to be natural habitats because their existence is not normally dependent on grazing (or other human activities).

It is important to point out that natural agricultural habitats are not pristine habitats, or necessarily primeval habitats, because they will all have been affected to some degree by the act of grazing itself, as well as other human activities, such as increased fires, drainage and eutrophication[2] (Figure 1).

[2] The increasing fertility (nutrient levels) in ecosystems through intentional use of livestock manure, artificial fertilizer and water or air-borne pollution.

Figure 1: The processes which lead to the formation and modification of agricultural and grassland habitats in Europe

Dashed lines indicate changes that are particularly slow by nature or that cannot be easily or quickly



Source: modified from Goriup (1988).

Most natural agricultural habitats, and virtually all natural forests, have now been lost in Europe as result of these activities, as well as forest clearance and the conversion of grasslands to croplands (for cultivated and permanent crops). Nevertheless, the legacy of low-intensity and diverse traditional agricultural practices and their interactions with the varying climates, topography and soils of Europe has created a rich diversity of landscapes and habitats. Indeed, although natural habitats declined as agriculture spread, new and diverse semi-natural habitats[3] were created with novel species communities, which initially probably increased species richness across much of Europe (Baumann, 2006; Ellenberg, 1988; Kornas, 1983; Stoate, 2011). Furthermore, some of the semi-natural habitats that arose, such as wood pastures, hay meadows and heathlands that are dependent on livestock grazing for their maintenance are likely to be analogous to some former natural habitats, that were dependent on grazing by wild herbivores (Goriup, 1988; Vera, 2000).

Over the last hundred years and particularly since the 1950s, drivers of agricultural development (see Section 2.4) have led to widespread agricultural improvements and the intensification of management. As a result, many of the semi-natural habitats and elements that were created by extensive agricultural practices have been lost, resulting in highly modified and simplified agricultural habitats and landscapes.

It is clear from numerous studies, including those reviewed in this report, that these changes have had major impacts on biodiversity. This is because the key determinant of the richness and abundance of biodiversity associated with agricultural habitats is the degree to which they have been modified from their natural state (eg as a result of grazing, one-off or occasional agricultural improvements, ploughing and conversion from grasslands to crops) and the intensification or modernisation of management (eg cultivations, the use of fertilisers, irrigation and pesticides) and specialisation in particular intensive systems. Consequently, most of the more high yielding and economically attractive farming systems and their associated agricultural practices are hostile to many species and often no longer provide sufficient food resources for wild species that would otherwise tolerate the conditions (see further discussion in Section 2.2).

Agricultural improvements often go together and lead from one to another. For example, to agriculturally improve semi-natural wet grasslands, drainage is usually necessary before the application of fertilisers and herbicides is possible and economically worthwhile. In turn, once fertilisers are used, it may become advantageous to reseed the grassland with fast-growing competitive cultivars (eg *Lolium* spp) and then to cut the grass and store it as silage for housed livestock, which often is more efficient (in terms of converting grass to meat or milk) than grazing grassland. Therefore, although some agricultural changes can be gradual, and development pathways vary across Europe, agricultural habitats of varying biodiversity importance can be distinguished thatreflect their original vegetation and degree of agricultural improvement. Firstly, three prominent broad classes of agricultural habitat can be distinguished according to their predominant types of vegetation and typically associated biodiversity. These are:

[3] Sometimes referred to as 'cultural habitats'.

- permanent grasslands and other forms of natural or semi-natural vegetation that are grazed by livestock;
- cultivated croplands, including temporary grasslands which are often converted from permanent grasslands; and
- permanent crops.

The three broad classes of agricultural habitat type can be further subdivided according to their degree of modification and intensity of management, because these factors have a profound impact on biodiversity. Such divisions could be numerous and it is difficult to define boundaries between them, but permanent grasslands[4], shrublands and other grazed habitats can be divided as follows:

- natural habitats that are extensively grazed, but are not dependent on grazing for maintenance and have not been significantly changed by livestock grazing or other human activities;

- semi-natural habitats (ie vegetation and associated species, that has not been planted and is dominated by native species, but is the result of human activities, for example woodland clearance, grazing and burning) that are:

  - pastures which are dependent on livestock grazing for their maintenance; or

  - meadows which are dependent on mowing (usually for hay) for their maintenance, although they may also be grazed at some times of year.

- improved permanent grasslands which have been agriculturally improved through some form of physical works such as drainage, fertilisation or reseeding.

Most cultivated and permanent croplands in Europe are currently intensively managed, but as further described in Section 2.3.3 some extensive cereals (for example on poor soils, dry, saline or waterlogged areas, or in remote locations) and old traditionally managed orchards (see Section 2.3.4) are notably richer in biodiversity. Thus there are strong grounds for distinguishing extensively cultivated crops and extensive permanent crops from intensive systems from a biodiversity perspective.

These further subdivisions result in eight broad types of agricultural habitat (see
Table 1). However, as summarised in Section 2.3.3 below and described in more detail in Annex 2.1 (p227), organic farming systems differ significantly and consistently from conventional improved grasslands and especially intensively cultivated arable and permanent crops, particularly in their avoidance of artificial fertilisers and very limited use of pesticides. To maintain soil fertility such systems use livestock manure and/or crop rotations (creating high habitat diversity) that often incorporate green manure crops (ie nitrogen-fixing crops such as legumes). Although the botanical diversity of some organic grasslands is reduced by the use of high amounts of slurry as fertiliser, they benefit from

[4] As defined ecologically as old grasslands or infrequently ploughed grasslands (typically at least five years old).

generally being older permanent grasslands that are not affected by herbicides. Stocking levels also tend to be lower (to help avoid disease build-up and transmission) and traditional breeds are often used, sometimes in rotation between species. Organic crops are generally protected from weeds and invertebrate pests by rotations (which help prevent the build up of weed and pest populations), biological methods which maintain populations of parasites and predators of pests, and mechanical operations. Such techniques help to maintain the biological condition of soils and, although it is not normally their intention, non-crop plants and invertebrate abundance in crops tend to be higher than in conventional crops. Non-farmed features such as hedges, grass strips and ditches also tend to be kept as shelter / barriers for crops and livestock and as over-winter habitat for predators of pests, such as in so called ‘beetle banks’. Furthermore such habitats are often of higher quality for wildlife as they are not affected by fertilisers and pesticides.

To some extent organic systems are similar to low intensity systems, such as those in parts of southern and eastern Europe, but they result from a positive decision to follow such practices. Consequently because of this and their different farming practices and biodiversity compared to otherwise analogous conventional intensive systems, they are treated separately in this study. Thus the resulting field-scale typology for the EU results in 11 broad types of agricultural habitat, as illustrated in
Table 1 below. The table provides a summary of the key farming practices that shape these habitats and their associated biodiversity, together with examples of more specific habitat types and illustrates how these habitat types relate to agricultural systems more generally, using FADN categories.
It is relevant to note that the typology adopted in this study is broadly compatible with the High Nature Value (HNV) farmland definition and typology (Cooper *et al,* 2007), which is widely recognised across Europe, by conservationists and policy makers. However, unlike this study, the HNV typology does not distinguish between natural and semi-natural habitats. Furthermore the HNV typology focusses more on systems and therefore recognises mixed farmland, which is not distinguished in this study because landscape-scale attributes of farmland are considered to be too complex and vary on a continuum (see Section 2.1.2).

Table 1: A broad field-scale typology of agricultural habitats according to the main links between farming practices and biodiversity in the EU

	Permanent grasslands and other grazed habitats					Crops					
Habitat types	Natural habitats	Semi-natural habitats		Improved grassland		Cultivated			Permanent		
		Pastures	Meadows	Organic	Conventional	Extensive	Organic	Intensive	Extensive	Organic	Intensive
Grazing / mowing	Low grazing levels due to low productivity	Habitat created by & dependent on moderate grazing	Habitat created by & dependent on moderate grazing and cutting for hay	High grazing densities and/or cutting for hay or silage	High grazing densities and/or cutting for hay or silage	Crop residues and fallow land are often grazed	Temporary grasslands usually cut for silage and grazed	Temporary grasslands usually cut for silage, often no grazing with animals	Traditional orchards, olive groves etc may be grazed		None
Cultivation & planting	Never	None or very old		Mostly old	Many are occasionally re-sown	Annual or frequent (< 5 years) for arable			Very infrequent; trees may be very old in traditional orchards and olive groves		Infrequent
Rotations and fallow periods	Na	Na	Na	None	Usually none	Used to maintain soil fertility & condition		Variable, often only break crops or repeat cropping	None		
Hydrology	Natural	Natural or minor improvements		Drained if necessary		Unmanaged	Drained if necessary	Drained and/or irrigated if necessary	Unmanaged	Sometimes irrigated	Often irrigated
Fertiliser	Never	Usually none	None or occasional organic manure or nutrient rich flooding	Regular use of organic manure	Regular fertiliser use and/or organic manure	Occasional use, dung from livestock	None, other than livestock manure	High annual NPK use	Occasional use	None, other than livestock manure	High amounts used annually
Pesticides	Never	Very rarely		Organic crop protection methods sometimes used	Occasionally as needed	Occasional use	Organic crop protection methods sometimes	Used annually, primarily prophylactically	Occasional use	Organic crop protection methods sometimes used	Used annually, primarily prophylactically

	Permanent grasslands and other grazed habitats					Crops					
Habitat types	Natural habitats	Semi-natural habitats		Improved grassland		Cultivated			Permanent		
		Pastures	Meadows	Organic	Conventional	Extensive	Organic	Intensive	Extensive	Organic	Intensive
Typical agricultural products / use	Meat	Meat or low productivity dairy	Meat or low productivity dairy and hay	Meat or dairy and/or hay or silage		Cereals and fodder crops	Cereals, fodder crops, oil-seeds, cotton, tobacco, rice, vegetables & sugar beet		Fruit, citrus fruit, grapes, olives and nuts		
Resulting vegetation	Near natural species & communities	Species-rich, native species communities	Often highly species-rich, native species communities	Often dominated by non-native grasses; Organic: may have higher plant diversity		Predominantly crop, but with some adaptable plants; varied vegetation in fallow fields	Monocultures of cultivars at field-scale		Usually monocultures of cultivars at field-scale		
Examples of habitats	Montane grasslands, blanket bogs, tundra, semi-desert, salt-steppes, coastal marshes	Dry grasslands, shrublands, pastoral woodlands	Floodplain meadows and upland meadows	Typical permanent lowland grasslands		Dry cereal production ('psuedo-steppe') in Iberia & SE Europe	Some arable farmland	Typical intensive arable farmland	Old olive groves, vineyards and orchards in S Europe	Some permanent crops	Typical fruit and nut systems in most of Europe
Typical FADN farm types (all subtypes included unless indicated)	42. Specialist cattle-rearing and fattening 44 Sheep goats and other grazing livestock			4. Specialist grazing livestock 5. Specialist granivore 6. Mixed livestock		1. Specialist field crops 8. Mixed crops-livestock	1. Specialist field crops 2. Specialist horticulture 6. Mixed cropping 8. Mixed crops-livestock		3. Specialist permanent crops 6. Mixed cropping 8. Mixed crops-livestock	3. Specialist permanent crops 6. Mixed cropping	

2.1.2 Landscape-scale influences on biodiversity

The ecological processes and species associated with agricultural habitats described above are also affected greatly by three important landscape-related factors:

- Spatial scale of the fields and farming system (eg from very small-scale strip farming, to enclosed fields or extensive unenclosed landscapes).

- The presence and ecological quality of field boundary habitats (eg hedges and ditches, uncropped strips) and other non-farmed habitat features (eg trees and ponds).

- Landscape diversity, in terms of:
  - composition (ie habitat and boundary types);
  - structure (ie scale of fields and other elements); and
  - interactions with other habitat types other than farmland (eg forests, wetlands, and urban areas etc).

The spatial scale of fields and other agricultural landscape components (eg non-farmed areas of rough grassland and scrub etc) is important because some species have particular requirements in terms of habitat area and its spatial configuration. For example, high-level predators, including many larger carnivorous mammals and birds of prey require large areas of habitat for foraging. They therefore favour expansive areas of unbroken or interconnected habitat. Other species, such as many ground-nesting birds, favour open habitats (for example without enclosing tall hedgerows or trees) because such farmland enables them to see approaching predators at a distance. In addition, some bird species, such bustards, swans and geese require space to take off.

In contrast some species rely on hedgerows and other features as a refuge from predators, and for food (see further discussion in 'Hedgerows and boundary management' in Annex 2.1, p242), and therefore favour landscapes with considerable cover, often in the form of field boundaries. As landscapes become increasingly dominated by scattered trees or closed-canopy forest then the species present in patches of agricultural habitat tend to be increasingly generalist forest species. These typically breed in the forest habitats and use the agricultural habitats for foraging.

The variety of habitats that are present is also important for some species that have different requirements for breeding and feeding etc, which may also vary according to season (see 'Crop types and rotations' in Annex 2.1, p239). For example, many farmland birds, such as the Yellowhammer (*Emberiza citrinnela*) require tall vegetation such as hedgerows scrub or grass, for nesting, insect rich habitats for feeding their young and seed-rich weedy habitats in winter (Stoate and Szczur, 2001). The required variations in habitat can be relatively subtle, as further discussed in Annex 2.1 on crop rotations.

The interactions between the variety of habitats (and variation within these) and the scale of elements in the landscape result in considerable variations in diversity across a range of scales. Local community diversity, which is referred to as alpha (α) diversity by ecologists, is often measured in terms of the number of species (ie species richness) and at a very small-scale, for example species per square metre. Habitats with high α diversity (such as semi-natural hay meadows, with their rich flora and associated invertebrates) tend to be regarded as being of high conservation value. However, the diversity between communities/ habitats, (ie their variety and distinctiveness), known as Beta (β) diversity, is also important. Alpha and Beta diversity components contribute to overall landscape diversity, referred to as gamma (ϒ) diversity (Anderson *et al,* 2011).

The range of interactions between these scales of diversity are illustrated in Figure 2 below, which depicts the hypothetical occurrence of species in four types of agriculture landscape. Example A depicts an extensive area of natural habitat (such as tundra, bogs and steppelands), which are often dominated by one main community type that is moderately diverse and varies subtly across the landscape. Although natural habitats may have relatively low diversity compared to some semi-natural habitats, they are usually of very high biodiversity importance because they support species that are often found nowhere else, often in abundance (see Section 2.3.2). Such species populations are therefore of very high importance in terms of avoiding extinctions at national, EU and even global scales.

Semi-natural farmland landscapes (example B) often show very high levels of small-scale diversity as a result of low intensity disturbances from grazing and cutting (see 'Grazing' in Annex 2.1, p227) and micro variations in soil conditions and hydrology etc that have not been lessened through agricultural improvements (such as drainage and fertilisation). As a result such habitats can be highly species rich. They may also hold a significant number of specialised species, for which their original natural habitats may no longer exist. Despite the high levels of local diversity, landscape scale diversity can be limited in some semi-natural landscapes (as depicted in the example), because there may be little variation between fields in the way that they are farmed and boundary features such as hedgerows and other non-farmed habitats may be absent. In other situations complex agricultural landscapes may arise as a result of interactions between their physical diversity, in terms of topography, soils and climate, and historic cultural factors, such as ownership patterns and management methods).

Example C depicts a mixed farmland landscape in which the fields have undergone some agricultural improvement and therefore have a lower local diversity than in the semi-natural habitats (example B). However, the agricultural improvements have led to the break-up of larger fields into smaller units, with the introduction of associated hedgerows, and the diversification of farm crops and practices. As a result, whilst the local diversity is low, between habitat diversity (Beta diversity) is high, which results in the highest overall landscape diversity of all the depicted examples. Consequently, studies have shown that mixed farmland landscapes with associated non-farmed habitats can support more species than other habitats (Tucker, 1997). For these reasons, mixed farming systems are often considered to be HNV farmland, especially where less improved or some semi-natural farmland is present.

Figure 2: A schematic illustration of differing scales and levels of diversity in a landscape

Dark margins represent the border of the agricultural landscape, cells within indicate borders between habitats (ie fields). The examples are purely illustrative, with each number depicting the identity of an individual species within each example landscape type (numbers do NOT correspond to the same species across examples). Specialised species that are primarily restricted to the habitat type are indicated in bold type. Summary diversity data (in terms of species richness) are provided below each landscape example. Local and between community values are not calculated but summarised in relative terms.

a. Natural habitat

1 2 3 4 5 6 7 8 9 10 11 12

Diversity summary:
Local = moderate
Between community = low
Landscape = 12
Specialised species = 10

b. Semi-natural grasslands

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17	**1 2 4** 5 8 9 10 11 12 13 15 16 17 **18** 19
3 4 5 7 8 9 12 13 14 16 17 **18**	**1 2** 6 7 8 9 10 11 12 14 15 16 17 20

Diversity summary:
Local = high
Between community = moderate
Landscape = 20
Specialised species = 5

c. Improved mixed agriculture

1 2 3 4 5	1 3 4 **6**	2 4 **6** 7	8 9 10 11
3 **6** 7	**12** 13 14 15	2 4 7	1 2 4 5 **6**
14 16 17 18	2 3 4 5	8 9 10 11 19	2 4 **6** 7
2 3 4 5 6 7	8 9 10 11	14 17 18 20	21 22 23 24

Diversity summary:
Local = low
Between community = high
Landscape = 24
Specialised species = 2

d. Intensive croplands

1 2 3
1 3 4

Diversity summary:
Local = very low
Between community = low
Landscape = 4
Specialised species = 0

It is important to note that a high proportion of species in mixed but improved agricultural landscapes are often generalist species (including those in non-farmed habitats) and mostly of low conservation value because, although many are declining, they are relatively common and therefore not currently threatened. Typically few specialist species are present. Indeed, the act of increasing habitat diversity, through for example the introduction of hedgerows and farm woodlands is often the cause of loss of some specialist agricultural species that require large expanses of open habitat (such as the Skylark (*Alauda arvensis*). Thus, for example, the introduction of conifer forest plantations to bogs in the UK had severe detrimental impacts on breeding birds of international conservation importance, and the growing of Eucalyptus on steppic habitats has increased pressures on globally threatened bustards (Tucker and Evans, 1997).

As noted by (Hendrickx *et al,* 2007) these observations indicate that it is important that conservation of diverse agricultural landscapes should focus on species enhancement of entire agricultural areas, rather than just on the diversity of local communities. But it must be remembered that measures that increase species diversity (at local or large-scales) do not necessarily provide conservation benefits: much depends on the importance of the habitat concerned and whether additional species are characteristic of the habitat.

Example D depicts a typical intensive arable farming system. In this example some of the fields have been amalgamated and they have very low local (in field) diversity levels as a result of the impacts of cultivation, high fertiliser and pesticide use etc (see Section 2.2). Between habitat (Beta) diversity is also low due to crop specialisation and the abandonment of crop rotations. Consequently many intensively farmed landscapes are dominated by one or two cultivated crops, and only a small set of species is adapted to the high disturbance levels of such agricultural fields (Maelfait and De Keer, 1990; Samu and Szinetar, 2002). Furthermore, many intensive landscapes lack boundary habitats and features as well as other non-farmed features (Farmer *et al,* 2008a). These factors result in very low landscape-scale diversity levels in areas dominated by intensive farming, whether they are permanent or cultivated crops.

Habitat fragmentation is an important characteristic of many agricultural landscapes, especially in areas dominated by intensive agriculture. In such landscapes, remaining patches of potentially high biodiversity natural/semi-natural habitat are embedded in a matrix of intensively farmed habitat, which species from the high biodiversity patch cannot easily cross. This situation has been equated to islands in an inhospitable sea (MacArthur and Wilson, 1967). If the habitat patches are large enough they may support self sustaining populations. Populations in small habitat patches are often at risk of chance extinctions, but may be sustained by immigration from other patches, creating what are known as meta-populations (Hanski *et al*. 1995; Hanski 1998). Consequently, when suitable habitat patches become simultaneously reduced in size and more distant from each other, populations may go extinct and remain so if the dispersal capacities of the involved species are low (Thomas 2000; Fahrig 2003; Colas, Thomas & Hanski 2004; Parvinen 2004). As Hendrickx *et al* (2007) note, 'this can lead to a strong impoverishment of the local diversity'.

Such landscape factors seem to constrain the benefits of organic farming when such farms occur in largely intensively farmed landscapes (Kleijn *et al,* 2001; Weibull *et al,* 2000) - see Annex 2.2 (p244). Similarly, the relatively limited biodiversity benefits of some contemporary agri-environment measures described in Chapter 3 may also be partly due to the landscape scale effects, which cannot be easily reversed by measures across relatively sparse and isolated habitat patches (Batáry *et al,* 2010; Bengtsson *et al,* 2005; Bergman *et al,* 2004; Concepción *et al,* 2008; Kleijn *et al,* 2004; Kleijn and Sutherland, 2003; Sutherland, 2002; Tscharntke *et al,* 2011).

The figure of course illustrates four relatively extreme hypothetical examples of habitat composition and landscape structure where ecological impacts of landscape structure are evident. In reality most landscapes will consist of mixes of these. Due to this complexity, and the scale of analysis needed to investigate the issue, relatively few studies have been carried out on the interrelationships between biodiversity and landscape-scale factors related to agriculture. Instead most studies have assessed biodiversity relationships in terms of local-scale (alpha diversity) impacts.

However, an extensive study of arthropod diversity in agricultural landscapes found that both local (alpha) and between habitat (Beta) diversity had important influences on the overall landscape-scale diversity of the taxa groups studied (Hendrickx *et al,* 2007). As noted in other studies, local diversity decreased as a result of increases in management intensity of the agricultural fields. But, importantly, total landscape species richness of all groups was most strongly affected by proximity of semi-natural habitat patches. The results implied that local communities of landscapes consisting of small and unconnected habitat patches are characterised by a species composition that hardly diverges between patches (ie has low Beta diversity). This homogenizing effect seems to occur as a result of the depletion of specialist, and typically more competitive, species (Tilman *et al*. 1994) primarily characterised by low dispersal capacities (de Vries, den Boer & van Dijk 1996). Vacant niches within the local communities can then be replaced by species of the surrounding agricultural matrix. This highlights the importance of evaluating the impacts of agri-environment measures, and other conservation actions, according to the various scales of diversity, and not just local diversity impacts (see Chapter 3 for discussion of agri-environment schemes and their impacts).

Although landscape-scale factors (such as field size, crop diversity and the presence of non-farmed habitats) undoubtedly have important influences on biodiversity these are generally secondary to habitat type. Furthermore, such factors tend to show continuous rather than discrete variations and are the result of very complex interactions with agriculture and other land uses. For this reason, landscape diversity factors are not incorporated into the agricultural habitat typology described above, which instead focusses on simpler field-scale characteristics. Nevertheless, the impacts of agricultural practices on farmland landscapes are considered in the following sections.

2.2 The interrelationships between agricultural practices and biodiversity

A detailed literature review of the impacts of key farming practices on biodiversity is provided in Annex 2.1 (p227), with a summary of the most significant impacts presented in Table 2 below. This examination clearly shows that farming practices, especially those affecting the soils and vegetation within the fields (ie in-field characteristics) profoundly affect biodiversity, especially threatened and declining species. It is therefore imperative that management measures for farmland species address these key agricultural practices.

It is also evident that the impacts of practices normally vary according to habitat type. For instance grazing in natural habitats is very often detrimental, because of the low productivity of the ecosystem, fragility of soils and sensitivity of many plant species. In contrast, grazing is essential for most semi-natural grasslands, and some also benefit from the traditional cutting of hay. The nature and intensity of management practices is also of key importance, such that, for example, optimal levels of grazing can help maintain habitats, but over and under-grazing can be damaging. However, the situation is complex because optimal levels for practices such as grazing, cutting, hydrological management, burning and even use of manure, vary according to local circumstances (eg soil type, vegetation type and condition, climate, historical management and current management objectives).

In mixed farmland (ie grasslands and croplands) land use practices, such as crop rotations, and especially the use of fallow land have important landscape influences. Such practices help maintain crop diversity which in turn increases biodiversity in many farming landscapes. Maintaining some land as permanent grassland (or perennial crops) is beneficial for biodiversity, because the absence of ploughing allows soil organic matter and soil fauna levels to build up, with knock-on benefits for species higher up the food chain, such as soil-invertebrate feeding birds. Particularly old grasslands that have never, or rarely, been ploughed are especially valuable in this respect, and may also be botanically rich.

Boundary features such as hedgerows, trees, ponds, ditches, stone terraces and uncropped areas with patches of rough grass or scrub etc also provide important habitat elements in many farmland landscapes. They provide important cover and food resources for some farmland species. However, typically their greatest value is in enabling some species of forest, wetland, scrub and rocky habitats to exist in otherwise agricultural dominated areas, thereby greatly increasing between habitat and overall landscape-scale diversity. Such linear habitat strips and patches also facilitate the movement of some species through what would otherwise be a hostile landscape. However, many species that use farmland hedgerows etc tend to be generalists, and therefore common and widespread species, especially in the most intensively farmed landscapes. It is also important to point out that some species of open farmed landscapes, such as the steppe grasslands and moorlands, are detrimentally affected by the introduction of trees and boundary features. This is because many of the species present avoid enclosed landscapes in order to elude predators.

Some practices, such as annual cultivations, pesticide use, drainage and irrigation and the use of artificial fertilisers are nearly always detrimental to biodiversity. Therefore conservation measures need to avoid or reduce the impacts of these practices (eg by reducing them to below critical thresholds, if they exist). Such mitigation can include delaying ploughing so that winter stubbles are retained, and leaving cereal field margins unsprayed with pesticides. Actions may also be required to compensate for unavoidable impacts, through targeted replacement of habitat components. For example, sowing field margins with plants that provide high density food resources (eg seeds for birds, nectar-rich plants for pollinators) or creating bare fallow patches in the crop for ground nesting birds-).

Table 2: Summary of principal impacts of key agricultural practices on biodiversity

	Permanent grasslands and other grazed habitats					Crops					
Habitat types	Natural habitats	Semi-natural habitats		Improved grassland		Cultivated			Permanent		
		Pastures	Meadows	Organic	Conventional	Extensive	Organic	Intensive	Extensive	Organic	Intensive
Grazing	Grazing is normally not required, and may be detrimental to sensitive species	Extensive grazing is normally the prime factor that maintains the habitat, appropriate grazing also increases botanical diversity, and associated fauna	Seasonal grazing helps to maintain botanical diversity, and associated fauna	Outdoor grazing can provide benefits, especially for invertebrates and birds	Grazing levels are often too high to maintain plant diversity and associated fauna; can provide feedings benefits for birds, but high nest losses from trampling	Grazing of fallows and stubbles is important for biodiversity	Temporary grasslands are sometimes grazed, but stocking levels too high to maintain plant diversity and associated fauna; can provide feedings benefits for birds, but high nest losses from trampling		Grazing of fallows and stubbles is beneficial for biodiversity		Not grazed
Mowing	NA	NA	Mowing for hay at appropriate times maintains the habitat and increases biodiversity	Mowing is normally for silage and is early and frequent, reducing plant and animal diversity, and causing high losses of ground nesting birds, but losses can be reduced by wildlife friendly cutting		NA	Mowing of temporary grasslands is normally for silage and is early and frequent, reducing plant and animal diversity, and causing high losses of ground nesting birds, but these can be reduced by wildlife friendly cutting		Some mowing for hay, which can increase biodiversity		Not mown
Cultivation & planting	Destroys the habitat	Normally causes significant damage, restoration can be difficult or impossible		Cultivation and reseeding of grasslands results in loss of semi0-natural elements and much reduced biodiversity, recovery is possible if seedbanks remain but is slow		Frequent cultivations used to control weeds etc, damages soils and reduces biodiversity	Frequent cultivations used to control weeds etc, damages soils and reduces biodiversity				
Rotations and fallow periods	NA	NA		NA		Rotations, especially those that contain fallow, increase crop diversity, which provides more options for species in terms of food and breeding habitat. Fallow land also reduces cultivation frequency and associated soil impacts, and can also provide			NA		

						good breeding habitats for birds due to the lack of farming operations.					
Hydrology	Drainage is highly damaging, and hydrological management is not normally necessary	Drainage is highly damaging, but some habitats require or benefit from appropriate hydrological management eg to allow winter flooding, or high water tables		Some habitats may benefit from appropriate hydrological management eg to allow winter flooding, or high water stables		NA			NA		
Fertiliser	Usually destroys the habitat	High rates of artificial fertiliser, slurry and farmyard manure use reduces plant diversity and associated fauna				Absence of use helps support biodiversity	Very high rates of artificial fertiliser, slurry and farmyard manure use reduces plant diversity and associated fauna, and creates vegetation that is often too tall and dense for birds to nest and feed in		Low rates of use may reduce plant diversity	NAUse of manure may provide some benefits	NAUse has little impact due to highly artificial nature of the vegetation
Pesticides	NA	NA		Organic compounds used occasionally, usually with few significant impacts	Herbicide use has significant impacts on many species as a result of direct toxicity and indirect impacts from the disruption of food webs	Not normally used, but major impacts if they are	Organic compounds used occasionally, with similar biodiversity impacts to other pesticides	Pesticide use has significant impacts on many species as a result of direct toxicity and indirect impacts from the disruption of food webs	Not normally used, but major impacts if they are	Pesticide use has significant impacts on many species as a result of direct toxicity and indirect impacts from the disruption of food webs	
Irrigation	Destroys the habitat but not normally carried out	Not normally carried out	Traditional irrigation systems can increase habitat diversity	Traditional systems can increase habitat diversity, modern systems leads to significant intensification and associated significant detrimental impacts		Normally destroys the habitat if carried out	Leads to significant intensification and associated significant detrimental impacts		Normally destroys the habitat if carried out	Leads to significant intensification and associated significant detrimental impacts	

2.3 The biodiversity importance of agricultural habitat types

2.3.1 Overview

The review of agricultural practices above, and numerous other studies have shown that, in general, biodiversity importance (eg the diversity and abundance of characteristic species) and, in particular, threatened species that are the focus of EU conservation objectives) of farmland declines with increasing agricultural improvement and intensification (Aebischer, 1991; Donald, 1998; Donald *et al,* 2001; Billeter *et al,* 2007). This is reaffirmed by an assessment of the number of threatened habitats and species within selected taxa (ie with sufficient available data) that occur in each agricultural habitat type (as summarised in Table 3). However, it is important to note that these results do not negate the importance of conserving populations of more common and widespread species, although these may be of a lower priority.

Table 3: Agricultural habitats in the EU, their importance for selected threatened habitats and species, and their overall biodiversity importance

Key: HD = Habitats Directive, BD = Birds Directive

	Permanent grassland and other habitats grazed by livestock					Crops					
Habitat types	Natural habitats	Semi-natural habitats		Improved grassland		Cultivated			Permanent		
		Pastures	Meadows	Organic	Conventional	Extensive	Organic	Intensive	Extensive	Organic	Intensive
HD Annex 1 habitats[*1]	63										
BD Annex 1 species[*2]	54			32					5		
European HD Annex II Butterflies[*3]	9	25		0	0	0	0	0	0	0	0
European threatened amphibians[*4]	3	5		0		1	0		0	0	
European threatened reptiles[*5]	1	4		0		0	0		4	0	
Overall biodiversity importance	Very high, many species are restricted to such habitats	Very high, these habitats tend to be species-rich and declining; some species are restricted to such habitats and dependant on specific agricultural practices		Moderate, species diversity is much reduced compared to natural and semi-natural habitats, but some species of conservation importance use such habitats, sometimes in important numbers		High, such habitats are now rare and support some threatened species (esp birds)	Low, especially in intensive farmland dominated landscapes, but biodiversity levels can be enhanced by appropriate measures		Moderate - High, such habitats are declining and support some threatened species	Low, especially in intensive farmland dominated landscapes, but biodiversity levels can be enhanced by appropriate measures	

Sources: 1 Halada *et al* (2011); 2 adapted from Tucker and Evans (1997); 3 adapted from van Swaay *et al* (2006) using updated annexes available from Butterfly Conservation Europe (http://www.bc-europe.org/upload/Butterfly%20habitats%20-%20Appendix%201.pdf): 4 (Temple and Cox, 2009a); 5 (Temple and Cox, 2009b).
Note: Habitat divisions for each taxa group reflect the habitat types distinguished in the available data.

2.3.2 Natural and semi-natural habitats

Most remaining natural agricultural habitats in the EU (see Section 2.1.1 for definition) are of very high conservation value as they are much diminished, and many support species that are restricted to such habitats, many of which are also rare or endemic. Thus although some of these habitats are relatively species-poor in terms of small-scale diversity, they add greatly to regional diversity. Furthermore, the EU holds high proportions of the regional or global resources of some of these habitats, for example blanket bogs and their associated species. Their natural ecological conditions have particular scientific and educational values and their landscapes frequently have exceptional aesthetic appeal due to their large expanses, unbroken views and lack of obvious human intrusion.

Semi-natural agricultural habitats are of particular value for rare and otherwise threatened species of open habitats because they provide grass and shrub dominated habitats that are similar to previously present natural ecosystems (such as steppic grasslands). Such species are able to survive in these semi-natural agricultural habitats because they are not significantly affected by fertilisers, pesticides and mechanical operations etc.

Remaining natural habitats and most semi-natural habitats in the EU are listed on Annex I of the Habitats Directive and should therefore be the subject of special conservation measures including protection in Special Conservation Areas. As part of the work programme of the European Topic Centre on Biodiversity (ETC/BD), Halada *et al* (2011) recently assessed the dependency of all Annex I habitats on agricultural activities (especially grazing or mowing). In total they identified 63 habitats that are dependent on agriculture to some extent, 23 of which are listed as Priority Habitats in the Directive. Of the 63 habitats, 25 are considered to be fully dependent on agricultural activities (and are therefore sensitive to agricultural abandonment) and these are listed in Annex 2.3 (p248).

Many species listed in Annex I of the Birds Directive and Annex II of the Habitats Directive are highly or exclusively dependent on natural or semi-natural habitats (because they have specialised ecological requirements), including agricultural habitats.

Natural succession in semi-natural habitats is prevented by low intensity agricultural grazing and cutting (and in some habitats burning) practices that vary considerably according to local conditions and traditions. The variation in agricultural practices in semi-natral habitats (eg relating to stock type and density, and the timing of grazing and cutting) tends to create heterogeneous fields and landscapes, which results in high levels of species diversity, further increasing their typical biodiversity importance. For example, an analysis of birds listed in Annex I of the Birds Directive reveals that some 54 species regularly occur in natural and semi-natural habitats (Table 4). Table 4 summarises the number of bird species listed in Annex I of the Birds Directive that have more than 10 per cent of their European population in one or more agricultural habitat types according to Birdlife International (Tucker & Evans, 1997). In total, 62 out of the 195 birds listed in Annex I of the Birds Directive are considered to be agricultural species. The findings indicate that semi-natural grassland habitats are particularly important, especially steppe grasslands as they are relatively restricted in the EU yet still hold significant populations of 32 key agricultural bird species. Semi-natural Mediterranean shrublands and wet grasslands are also particularly important.

Table 4: Totals of agricultural bird species according to habitat type and conservation status category

Key: Moor = grazed moorland and tundra; Med = grazed Mediterranean shrublands; AIG = arable and improved grasslands; SG = steppe grasslands; MG = montane grasslands; WG = wet grasslands; PC = permanent crops; PW = pastoral woodlands. NB. The number of species occurring in all habitats is not equal to the sum of totals in each habitat, because many species occur in more than one habitat type. Habitat use relates to the proportion of the European population that is estimated to occur within each habitat.

	All	Moor	Med	AIG	SG	MG	WG	PC	PW
Total agricultural species	62	3	21	32	32	6	13	5	12
Unfavourable status	55	3	19	28	27	5	12	5	10
Habitat use									
• 10-75% of population		0	11	22	21	5	10	5	11
• >75% of population		3	10	10	11	1	3	0	1

Source: adapted from Tucker and Evans (1997)

Natural and semi-natural habitats are particularly important for butterflies, with some 9 and 25 species listed in Annex II of the habitats Directive occurring in them respectively (see Table 3). Butterfly species occur also in significant numbers in other agricultural habitats. A detailed analysis of the occurrences of all butterfly species according to CORINE biotopes reveals that some natural habitats, such as raised bogs, blanket bogs and sand dunes, which are sometimes grazed by livestock, are of most importance for threatened butterflies (see Annex 2.4, p250). Semi-natural agricultural habitats, for example mesophile grasslands, humid grasslands and tall herb communities, dry grasslands and steppes, and heath and scrub, all have high species richness and support more than 10 per cent of threatened butterfly species.

2.3.3 Improved grasslands and croplands

Conventional improved and intensive systems

It is important to note that there is often a gradual transition from semi-natural extensively used grasslands to improved grasslands, and as a result some ecologists refer to semi-improved grasslands. These may be improved, such as through the use of manure, but are lightly grazed and therefore, although they are no longer considered to be semi-natural, they may be species-rich rich in terms of plants, invertebrates and birds.

Despite the presence of some areas of semi-improved grasslands, most improved grasslands and croplands are at least an order of magnitude lower in their biodiversity value than semi-natural and natural habitats (and do not include any Annex I habitats), as a result of the impacts of drainage, fertiliser use, and reseeding etc (as discussed in Annex 2.1, p227). In fact, silage fields are often grass monocultures with no higher plants of high conservation value present at all, whilst even many permanent pastures have very low diversity (as a result of high fertiliser use and occasional ploughing). Many arable weeds are now extremely rare and consequently highly threatened (Stoate *et al,* 2009). Few butterflies, whether threatened or common, use such habitats and no threatened reptiles or amphibians.

Nevertheless, even improved grasslands and croplands do support some widespread and adaptable species, particularly birds. Such birds include a number of species listed in Annex I of the Birds Directive (see Table 4). Some improved grasslands provide, for example, favoured feeding sites for some internationally important wintering populations of geese and swans (which require protection under the Birds Directive). Permanent grasslands can also support important populations of invertebrate feeding birds, especially in winter.

It is also important to note that even very common and widespread species have significant conservation value. As they are usually the last remaining visible vestiges of nature in many farmland landscapes they are particularly appreciated by the wider public and consequently have high cultural values. Although few species in such habitats are actually threatened, declines in populations and range can result in significant losses of public benefits, for example in terms of the cultural and aesthetic values of the countryside.

Organic systems

As described in Section 2.1.1 above (see also Annex 2.1 (p227) and Annex 2.2(p244)), organic systems tend to have a higher diversity of habitats, both non-farmed and farmed habitats, of higher ecological quality than conventional farming systems. Furthermore, there is now good evidence that the combined habitat characteristics of organic farms generally lead to higher within-farm and within-field species richness, and in some cases higher abundance, across most taxa (see Box 1) The main exception to this is for some species in taxa groups such as bees, butterflies and birds that are highly influenced by landscape-scale habitat properties and population dynamics (see discussion in Section 2.1.2). Thus an important limitation to the potential benefits of organic farming seems to be that in locations where organic farms are surrounded by less biodiverse conventional farmland, benefits may be constrained by a lack of source populations for colonisation of otherwise suitable habitat. Patches of organically managed habitat may also be insufficient for some species that require large areas of habitat.

Box 1: Summary of the main impacts of organic farming on biodiversity

Organic farming practices have been shown to result in greater within-farm landscape complexity and habitat diversity compared to conventional farms in comparable landscape settings (Gabriel *et al,* 2009; Gabriel *et al,* 2010; Norton *et al,* 2009; Winqvist *et al,* 2011). This includes:

- More mixed farming and greater crop diversity between fields in time and space

Organic farms are more likely to be mixed farms that include arable and livestock (European Commission, 2010a). Organic arable land has a higher proportion of fields with green fodder or green manure, such as grass-clover leys, and winter stubble, than conventional arable (European Commission, 2010a; Weibull *et al,* 2003), and crop rotations ensure a greater spatial and temporal diversity of crops. Organic dairy or livestock farms include some arable fields growing animal feed crops; which can be highly beneficial for some birds in otherwise grassland dominated landscapes (Robinson *et al,* 2001).

- More and better quality field boundaries

Field sizes are often smaller, so that the density of field boundaries on the farm is higher. Field margins also offer better quality and quantity of habitat: hedges on field boundaries are higher and wider because of less frequent management, less gappy and arable fields have wider and more permanent grass margins (Hole *et al,* 2005) (Chamberlain *et al,* 1999; Chamberlain *et al,* 2010; Jonason *et al,* 2011; Rundlöf and Smith, 2006).

- Greater within field diversity in arable fields

Arable crop structure on organic farms is more complex as a result of more spring-sown crops including cereals under-sown with the grass-clover ley, later spring sowing, and lower crop density due to the lower nitrogen availability. The lack of herbicide use means fields have a greater abundance and diversity of arable weeds, particularly broad-leaved weeds, within the crop (Hole *et al,* 2005). Organic fields are particularly rich in weed diversity in field centres compared to conventional fields, as a result of the different weed management practices and smaller organic field size (Gabriel *et al,* 2006).

- Possibly more and higher quality non-farmed habitats

Organic farms may have a higher abundance and quality of on-farm wildlife habitats and refuges, such as copses or shrub patches, ponds and wetland areas, or semi-natural grassland, than nearby conventional farms . But some studies have found that organic farms within farming landscapes with a historical small farm structure do not differ in size and structure from conventional farms in the same landscape (Gibson *et al,* 2007). The presence of non-farmed habitats may therefore be dependent on the motivation behind the adoption of organic farming, which may be value-oriented or more pragmatic (Darnhofer *et al,* 2005). This is likely to influence their investment of time and effort in the quality and quantity of non-economic features such as non-crop habitats on the farm (Ahnström *et al,* 2009).

Extensive arable systems

There are some areas where cropland systems, although not organic *per se*, are managed under traditional low input dryland systems, which can be species-rich and can therefore be considered to be HNV farmland habitats (Baldock, 1999). These habitats have sparse crops, high crop rotation diversity and retain a sizeable proportion of fallow and the presence of patches of semi-natural vegetation (Bota *et al,* 2005; Suárez *et al,* 1997). Such extensive cropping systems are rare but they occur in parts of eastern and southern Europe. Particularly important areas remain in dry areas of Spain and are of very high conservation importance, as they hold large proportions of some globally threatened birds, including Great Bustard (*Otis tarda*), Lesser Kestrel (*Falco naumanni*) and other European threatened species (Bota *et al,* 2005; Delgado and Moreira, 2000; Suárez *et al,* 1997; Tucker & Evans, 1997). Extensive cereal systems may also hold relatively species-rich plant and invertebrate communities.

As cultivated systems encapsulate a wide variety of habitats and practices, a significant number of species can be found within them under the right conditions. For example a review by BirdLife International revealed that some 32 species listed on Annex I of the Birds Directive have significant populations in improved grassland or arable habitats at some point in their annual cycle (see list in Annex 2.5, p251). However, most of the rarest species are associated with extensive systems and therefore these are a particular conservation priority.

2.3.4 Permanent crops

Permanent crops represent important areas of conservation value and can provide vital habitat refuges for endangered species. This is particularly true of traditional fruit and nut orchards, vineyards and olive groves. In HNV farming systems, key characteristics that are beneficial for biodiversity include large old trees and a semi-natural understory, which is often grazed by livestock (Baldock, 1999; Kabourakis, 1999).

Olive groves

Olive groves in Mediterranean regions provide essential habitat for a range of species, especially where there are old groves that are managed by low input, traditional farming systems. The importance of this habitat is particularly evident in the case of birds as they provide vital overwintering habitat for frugivorous and insectivorous birds from central and northern Europe. Originally, these migrations from the north would have been prompted by the abundance of high production of energy-rich fruits in the Mediterranean areas (Herrera 1982, 1984; cited in (Rey, 2011). Following the gradual replacement of the shrublands by olive plantations, olive agroecosystems have attracted large number of frugivorous birds which depend on these systems for their food supply over autumn and winter periods (Munoz-Cobo and Purroy 1980; Munoz-Cobo 1987; Rey, 1993). It is estimated that between 3.5 and 8 million frugivores over-winter in olive orchards in southern Spain alone (Rey, 2011).

Similarly, olive orchards have been found to provide useful foraging habitat for other species such as several species of insectivorous bat, including the endangered Mediterranean Horseshoe Bat (*Rhinolophus euryale*) (Russo, Jones and Migliozzi, 2002; cited in (Davy *et al,* 2007). Olive orchards may thus offer some protection against the impacts of deforestation by providing alternative foraging habitat and should, in certain cases, be considered alongside small woodland fragments in determining the management needed to increase their protection (Davy *et al,* 2007).

Olive orchards also host numerous species of arthropod species, including roughly 100 herbivorous insect species and others that are considered useful or neutral in terms olive production (Arambourg, 1986; Cirio, 1997; Varela and Gonzalez, 1999; Campos and Civantos, 2000; Ruiz and Montiel, 2000, all cited in (Cardenas *et al,* 2006).

Fruit orchards

Extensive orchards have long been part of the cultural landscape in Central Europe and are a highly diverse habitat. They are characterised by large, old fruit trees interspersed with species-rich herbaceous vegetation. Traditional fruit and nut orchards (such as apples, pears, plums, cherries, walnuts and chestnuts) that avoid the use of biocides and nitrogen fertiliser survive in most countries, albeit in restricted areas (Cooper *et al* 2007). In southern countries, the herbaceous understory may be removed to avoid competition for moisture with the trees, although well-timed occasional tillage (once or twice a year) can allow the development of a significant flora and fauna.

A number of farmland birds of European and/or regional concern are associated with extensive grazing systems in orchards (Tucker and Heath, 1994). Overall, 74 species of breeding bird have been associated with orchards with an average of 24-44 species per orchard (Cooper *et al,* 2007). Orchards may also be used for foraging by bats (eg Powys, 2002). Bees and wasps, which are important functional groups of terrestrial ecosystems as pollinators and predators (LaSalle and Gauld 1993 cited in (Steffan-Dewenter and Leschke, 2003), are also characteristic species groups in orchard meadows. Nest holes made in dead wood by wood-boring insects are particularly useful for above-ground nesting species and therefore more likely in older trees. Many species of bryophytes and lichens are also prevalent in orchards of fruit trees (POWYS, 2002).

Vineyards

Vineyards typically occupy sites with particularly warm and dry climates. They can host rare and endangered species such as the Grape Hyacinth (*Muscari racemosum*), a Red List plant species of Switzerland, and the spider species *Erigonoplus globipes*, which is generally rare in Central Europe (Hänggi *et al,* 1995 cited in Bruggisser, 2010), both of which can be very common in Swiss vineyards (Bruggissier *et al,* 2010). The biodiversity structure of vineyards depends on the management. In the north eastern region of Hungary, for instance, small heterogeneous vineyards were found to host considerably higher numbers of bird species than both the larger homogeneous and abandoned vineyards (Verhulst *et al,* 2004). However, abandoned vineyards had higher densities of some species, while intensively used vineyards were found to record significantly higher numbers of Skylarks (*Alauda arvensis*) and Linnets (*Carduelis cannabana*), compared to extensively managed vineyards.

2.3.5 Ecosystem services and agricultural habitat type

This section briefly describes some of the most important ecosystems services that are provided by agricultural habitats in Europe, with the focus being on those that are not associated with the production of agricultural commodities themselves. A more complete list of services and their estimated relative importance is provided in Annex 2.6 (p252).

Whilst the agricultural sector is a net contributor of greenhouse gas emissions (Cooper *et al,* 2009), a range of agricultural practices (eg no-till cultivation, crop rotations) can increase a soils' capacity for **carbon uptake and storage** (Lal, 2008). In general, soils can be either a source or a sink of carbon, and their carbon sequestration potential is highest under minimal levels of soil disturbance. Calculations of terrestrial carbon balances in European countries by Janssens *et al* (2005) show that grasslands are carbon sinks in all European countries, whereas croplands are net sources of carbon to the atmosphere. It has been estimated that since 1980 the organic carbon content of European soils has declined on average by 15 per cent in arable and rotational grass soils, 16per cent in soils under permanent managed grassland, and 23 per cent in soils on agriculturally managed, semi-natural land (EASAC, 2009). Carbon losses can be reduced through the adoption of farming practices which increase organic matter inputs to the soil and/or reduce soil disturbance, including reduced and zero tillage, set-aside, perennial crops and deep rooting crops, more efficient use of organic amendments, organic farming, extensification, and conversion of arable land to grassland or woodland (Smith, 2004). However, soil conservation and restoration measures cannot fully restore soil carbon lost through conversion to agriculture; the soil carbon pool attainable through best management practices is estimated to be only 60-70 per cent of the original soil carbon stored prior to conversion (Lal, 2008).

Agricultural habitats and their associated practices can have similar impacts on **water resources and quality**. Agriculture is one of the largest consumers of water in the EU, accounting 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, 2009b). Water quality is influenced by practices that lead direct pollution of aquifers and water courses from fertilisers, manure, pesticides and other agro-chemicals and indirectly through soil erosion. Therefore agricultural systems that maintain natural and semi-natural ecosystems can contribute to water provisioning because these do not draw on water supplies, but instead help to store clean water. If appropriately managed, their vegetation and soils retain water and thereby reduce surface flow rates (EASAC, 2009). This in turn contributes to groundwater recharge, helps even out flows into rivers, reduces erosion risks and traps pollutants. These services are much reduced or lost completely in more intensive systems due to vegetation disturbances from ploughing etc and the addition of pesticides and fertilisers to the land. However, detrimental agricultural impacts can be avoided or reduced through mitigation measures such as the use of minimum tillage systems, retention of permanent grassland in erosion prone areas, the use of terracing to reduce erosion and the judicious use of buffer strips to trap sediments etc.

In many parts of Europe, agriculture has played a significant role in shaping its **cultural heritage**, providing a **sense of place**, and **sustaining social capital** in rural areas (Cooper *et al,* 2009; Harrison *et al,* 2010). Many local traditions are based on the management of land and its associated biological resources (TEEB, 2011). Some agricultural landscapes provide **aesthetic benefits**, attract tourists and provide opportunities for **recreation** (Harrison *et al,* 2010; Sandhu *et al,* 2010). Based on a meta-analysis of 33 studies (all using 'willingness to pay' methods) from 11 European and 3 non-European countries, the average value of EU agricultural landscapes was estimated at €149 per hectare (Ciaian *et al,* 2011). The majority of studies included in the analysis assessed willingness to pay for preservation of the current agricultural landscape compared to abandonment, conversion to more intensive types of agriculture, or urban/industrial development. Grassland and permanent crops were found to have higher mean values (200 €/ha) than arable land (117 €/ha).

The discussion above and the table in Annex 2.6 (p252) indicate that the variety of ecosystem services is greatest in natural and semi-natural agricultural habitats. Furthermore, the magnitude of most benefits, other than the direct benefits from primary agricultural products (ie food etc) is highest in such habitats. This is largely due to the impacts of intensification on genetic diversity, soil condition and vegetation cover. However, it is also important to note that, by focussing on the benefits, this does not reflect the crucial role that soil ecosystems (and their interaction with vegetation and water) and other aspects of biodiversity, such as pollinators and pest-predators, play in supporting sustainable agricultural production. The supporting services that ecosystems provide to agricultural systems are a further reason for their conservation and sustainable management but it is beyond the scope of this study to describe or quantify their relationships with agricultural productivity and profitability.

2.4 Agricultural drivers and recent trends in the structure of the agricultural sector

As noted in Section 2.1 the presence and prevalence of different types of agricultural habitats in different regions of the EU-27 is influenced by a range of exogenous and policy drivers that affect the trajectory of agricultural development. Beyond the CAP, the key non-policy drivers that have and continue to influence agricultural restructuring include macro-economic developments, consumer behaviour, price development in agricultural commodities and input prices, technological development, trade agreements and the impacts of climate change. The combination of these drivers means that EU agriculture continues to undergo a process of profound structural change, with significant consequences for biodiversity.

Some of the principal changes in the structure of the agricultural sector that have been influenced by these drivers, particularly over the past 50 years, include specialisation, mechanisation, consolidation, farm diversification, intensification of some farming systems and extensification of others, the development of new products and markets (such as energy crops), cost cutting and reductions in labour inputs, the introduction of management systems such as organic farming and integrated crop management, abandonment of farmland, fragmentation of former collective holdings in the new Member States, and the loss of agricultural land as a result of land use changes. These changes have an impact on the nature of the farming practices used, the intensity of management of the land, which in turn impacts upon biodiversity.

In the past production support under the CAP has had profound influences on farming practices, in particular driving the intensification of EU agriculture with adverse impacts on biodiversity (Tucker *et al,* 2010). However, successive reforms of the CAP have reduced these pressures. Cross-compliance requirements were introduced with the CAP reform of 2003, attaching environmental conditions to the receipt of direct payments. Further development of agri-environment and rural development policies has encouraged new trends towards extensification, growth in organic farming, and farm diversification, among others. At the same time, the greater liberalisation of agricultural markets has increased the influence of markets on agricultural production decisions, bringing further pressure for consolidation, specialisation and in some areas increasing the risk of abandonment (IEEP and Veenecology, 2005; Keenleyside and Tucker, 2010).

Some of the key trends of relevance that have taken place in recent decades are summarised in Table 5, with supporting data and evidence provided in Annex 2 (p227). These trends are of relevance for the relationship between CAP and biodiversity, in that firstly they affect agricultural practices that impact directly on biodiversity (as described in Section 2.2 above), hence affecting the challenges and priorities for biodiversity conservation in agriculture in the EU, and secondly, have implications for policy measures designed to conserve biodiversity under the CAP. For example, the design, cost and uptake of agri-environment measures depends on the degree to which they are compatible with underlying trends in the agricultural sector. It should be noted that the wide range of drivers that influence these trends play out differently in different parts of the EU-27, depending on factors, including the economic, social, environmental situation of the area. More detailed examples of the way in which these trends have been experienced in the case study regions for this study can be found in Annex 1 (p224).

Table 5: Trends in EU Agriculture

CHANGE	DESCRIPTION	DRIVERS	TRENDS AT EU LEVEL	EFFECTS ON DIFFERENT AREAS	LIKELY SCALE AND FUTURE TRENDS	CONSEQUENCES FOR BIODIVERSITY
Specialisation	Increasing farm level and regional focus on particular systems and products, loss of mixed farming systems	Profit maximisation by exploiting comparative advantage and economies of scale, trade liberalisation	Significant trend across most parts of EU in recent decades, though relatively little change recorded in 2003 to 2007 period	Marked differences between Member States, with mixed farming still prominent in many of the new MS, reflecting less modernised agricultural systems	Trend is expected to continue to 2020, especially in more productive areas	Specialisation impacts negatively on habitat diversity
Mechanisation	Use of machinery to undertake tasks previously completed by hand	Labour costs and need to enhance farm incomes, finance for investment	Advanced trend across much of the EU, less advanced in some eastern and southern MS	Rates of change highest in least agriculturally developed areas; use of hand tools and horses widespread in some MS	Ongoing trend especially in parts of new Member States where agriculture is less capital intensive	Often results in intensification with negative consequences for biodiversity
Consolidation	Continuing concentration of agriculture into smaller numbers of larger units	Economies of scale and drive to increase farm incomes	Continuing trend across the EU in recent decades; number of holdings declined by 9% 2003 to 2007 in EU27.	Widespread trend but rates of consolidation most rapid in less developed areas. Very large variations in absolute farm sizes, with tendency for large farms in most productive, specialised areas and smallest in least developed areas	Major ongoing trend; number of holdings has been forecast to decline by one third 2003 to 2020, with more rapid decline in new MS	Increasing farm size does not necessarily harm biodiversity but may be accompanied by other structural changes
Diversification	Growth in other enterprises to supplement farm income	Need to enhance farm incomes, consumer demands (eg recreation, food)	Survey evidence indicates only a minority (12%) of EU farms are diversified – based on narrow definition – but that proportion is increasing.	Wide variations in rates of diversification across the EU, with highest rates in western and northern MS.	Ongoing trend	Other farm enterprises (eg tourism, local food) may be complementary to biodiversity conservation and may encourage measures to

CHANGE	DESCRIPTION	DRIVERS	TRENDS AT EU LEVEL	EFFECTS ON DIFFERENT AREAS	LIKELY SCALE AND FUTURE TRENDS	CONSEQUENCES FOR BIODIVERSITY
						protect/enhance biodiversity; alternatively could encourage developments and land use changes less sympathetic to biodiversity
Intensification/ extensification	Changes in input use, stocking densities, area of land on holding devoted to production	Product and input prices, consumer demands (eg organic food)	Major intensification of agriculture occurred in most parts of EU in latter half of 20th century. Recent trends indicate slight extensification in EU15 but intensification in NMS10 2004-2007.	Variations in intensity of production – 31% of farms in EU15 and 16% of those in NMS10 classed as high intensity in 2007. Evidence of convergence, with some extensification in the former and intensification in the latter. These overall trends likely to mask regional and sub-regional variations.	Lower prices will encourage extensification in some areas; however crop yields are expected to increase, driven by ongoing technological development. Intensive livestock systems expected to increase relative to extensive ones.	Pesticide use, fertiliser use, grazing pressure, maintenance of farmland features, balance between extensive and intensive livestock systems all have important impacts on biodiversity
New market/ product development	Development of new products, markets and farming systems – eg energy crops	Policy (eg climate policy) and market drivers	Growth in area of energy crops to 1.315mha in 2008.	Variations depending on regional growing conditions and national policies; highest production in most productive arable areas, especially DE, FR	Significant growth in energy crops expected to continue	May have positive or negative effects on habitat quality and diversity
Cost-cutting and labour saving	Adoption of more simplified approaches to management which require lower inputs and/or enable	Cost-price squeeze – combination of policy and sustained market price effects	EU27 agricultural labour force declined by 25% from 14.95 million annual work units in 2000, to 11.22 million in 2009	Wide variations in labour intensity of production, but decline in employment is occurring across the EU.	Ongoing trend especially in EU-15	Labour-saving usually has negative effects upon habitat quality and diversity, while reduction in other

CHANGE	DESCRIPTION	DRIVERS	TRENDS AT EU LEVEL	EFFECTS ON DIFFERENT AREAS	LIKELY SCALE AND FUTURE TRENDS	CONSEQUENCES FOR BIODIVERSITY
	shedding of labour					inputs may have positive or negative effects
Adoption of new management systems (ICM, organic, min-till)	Changing some fundamental elements of regular management practice in order to benefit environment, save costs and/or gain market advantage	Changing attitudes and technologies, research and development, consumer preferences	Area of organic land certified or in conversion increased from 4.9 million hectares in the EU27 in 2001 to 8.6 million hectares in 2009	Very wide variations in rates of uptake between MS. Organic area greatest in EU15, especially Austria and Sweden. ICM most prominent in UK.	Ongoing trend across EU-27, although still affecting only a minority of farmland	Generally positive impacts upon biodiversity (although some mixed impacts for min-till due to increased use of agro-chemical treatments)
Fragmentation of holdings and reversion to semi-subsistence farming	Farms splitting up as a result of landownership and institutional changes and the need to accommodate ex-urban unemployed returning to the family farm	Major economic restructuring in EU-12 and new Lander in Germany, following collapse of planned economies	Major trend in new MS in 1990s; consolidation now means that number of farms is declining in new MS, but there was an increase in Poland between 2003 and 2007.	Variations between new MS depending on previous institutional structures; average farm sizes typically less than 10 ha but 89 ha in Czech Republic.	Largely a feature of the 20 years from 1990 onwards, but its impacts are still very evident and the resulting structures persist due to lack of alternative opportunities for employment, in some areas	Mixed impacts upon biodiversity
Abandonment	Cessation of farming activity	Negative or low profitability of marginal farmland, difficulty of competing in competitive markets	Significant trend in some areas, on a small and local scale, not captured by official statistics.	Affects especially more marginal agricultural areas. Widespread abandonment occurred in new MS in 1990s but much has returned to production.	Significant levels of abandonment could occur in coming years, especially in marginal farming areas in southern, eastern and northern Europe	Negative effects from loss of high nature value farming, benefits for habitat re-creation in other areas
Land use change	Loss of farmland to urbanisation/ development pressure	Demand for land for development	Gradual and continuing trend; 0.5% of agricultural land lost between 2000 and 2006.	Greatest net loss of agriculture occurring in EU15. Pressure on biodiversity from development is particularly prevalent in	Ongoing small scale loss of farmland to other forms of development	Negative consequences of loss of habitat to built development

CHANGE	DESCRIPTION	DRIVERS	TRENDS AT EU LEVEL	EFFECTS ON DIFFERENT AREAS	LIKELY SCALE AND FUTURE TRENDS	CONSEQUENCES FOR BIODIVERSITY
				more prosperous rural and urban fringe areas and less so in more remote areas.		
Restructuring of rural economy	Declining share of agriculture relative to services, differences in level of performance, including decline and depopulation in some areas	Combination of above trends and drivers in wider economy	Growth in most rural economies. Varying population trends with growth in some areas and declines in others.	Wide variations in rural incomes; highest in rural Sweden, Denmark, Finland parts of Ireland (>125% of EU average) and lowest in Bulgaria and Romania (10% of average). Highest growth rates in new Member States, some localised economic declines. Relative dependence on primary sector varies (>20% employed in agriculture in some eastern and southern MS). Variable population trends (steady growth in most of EU15 but decline in some new MS).	Continuing decline in agriculture's relative significance.	Implications for society's needs from agricultural policy, including relative significance of demand for biodiversity and other public goods. Pressures on biodiversity from development or abandonment of economic activity. Pressures from population growth and associated development, but also possible opportunities from diversification and hobby farming.

2.5 Impacts of agricultural change on agricultural habitats and species

As described in the preceding section and Annex 2.7 (p256), a large proportion of semi-natural habitats are affected by one of two opposing trends: either, agricultural improvements and change (eg from grasslands to arable crops) and subsequent intensification of management, or marginalisation and abandonment. The biodiversity impacts of these trends on agricultural habitats are reviewed below. It should also be remembered that some of the most significant impacts of agricultural change, and especially intensification, will be external impacts on other habitats, including non-agricultural habitats such as wetlands and even marine ecosystems. Although an assessment of such impacts is beyond the scope of this study, some of the most important observed external impacts of agriculture on biodiversity are summarised in Annex 2.10 (p295).

2.5.1 Natural and semi-natural habitats

Overall impacts on habitats

A recent assessment by the EEA of Member State monitoring data on the condition of habitats of Community importance (collected in accordance with requirements under the Habitats Directive) indicated that a particularly low proportion of agricultural habitats have a favourable conservation status (EEA, 2010a). The Member State monitoring data on agricultural habitats have therefore been assessed in further detail as part of this study, with the methods and results summarised in (Annex 2.8, p274). The results reaffirm the broader findings of the EEA assessment, indicating that a substantial proportion of assessments of the status of all natural and semi-natural agricultural habitats were unfavourable. Coastal grazed habitats (eg coastal saltmarshes) and forests (eg wood pasture) have the highest proportion in unfavourable condition respectively. However, over 70 per cent of assessments were also unfavourable for bogs, mires and fens, grasslands and dune habitats, which is of considerable concern, as these are much more widespread habitats.

The results also indicated that a higher proportion of assessments were unfavourable in the north-west EU Member States (eg UK, Belgium and Ireland), which may be due to on-going agricultural improvements, but probably in some cases nutrient enrichment from atmospheric pollution (see Annex 2.10, p295). Some central European Member States (eg Czech Republic and Hungary) also have high proportions of habitats in an unfavourable status, probably as a result of a mixture of improvement/intensification impacts and abandonment.

Overall impacts on species of natural and semi-natural habitats

It is difficult to assess the status of species that are particularly associated with natural / semi-natural agricultural habitats in Europe as few data sets provide specific trends for taxa of these habitat types. However, a simple assessment of the conservation of birds listed on Annex I of the Birds Directive that are associated with semi-natural habitats is possible using the BirdLife International data provided in Table 4. This indicates that a very high proportion of species within all habitat types that are under agricultural management to some degree have an unfavourable conservation status (ie rare, localised and/or declining).

Clearly this means that bird species of Community interest associated with these habitats are under very high levels of pressure. The causes of declines in these species vary according to habitat and location, but the most commonly observed causes include habitat loss and fragmentation, especially resulting from afforestation, drainage, conversion to arable farmland or permanent crops and land abandonment (Pain and Pienkowski, 1997; Tucker & Evans, 1997; Wilson *et al,* 2009).

Further evidence of declining biodiversity in natural and semi-natural agricultural habitats in the EU comes from the European Grassland Butterfly Indicator, which is one of the indicators used by the EEA to assess the EU's progress with halting the loss of biodiversity[5]. The indicator uses data from national Butterfly Monitoring Schemes in fifteen countries from all over Europe, mostly in the EU. Seventeen species that are characteristic of grasslands are taken into account, and the majority of the populations of these species occur in semi-natural grasslands. The indicator shows that since 1990, grassland butterfly populations have declined in Europe by almost 70 per cent. Of the seventeen grassland species, ten have declined in Europe, two have remained stable, and five have uncertain trends. The negative trend in the EU-27 is a little less severe than in Europe as a whole, with a decline of almost 60 per cent over the period. As discussed in the new *Red List of European Butterflies* (Van Swaay *et al,* 2010), this might be due to the fact that the large decline of butterflies in NW Europe (countries all already in the EU for a long time) happened before 1990.

According to Van Swaay *et al* (2006) the main threats to butterflies of grassland habitats are land drainage, other agricultural improvements, land claims / coastal development and agricultural abandonment. A more recent assessment of threats to butterflies in different grassland habitats produced similar results and these as provided in Table 6.

[5] Streamlining European 2010 Biodiversity Indicators http://biodiversity.europa.eu/topics/sebi-indicators

Table 6: Main threats to European threatened grassland butterflies in different grassland habitats, averaged over countries

Scale: 1= low, 2 = medium, 3 = high.

Threat	Alpine and subalpine grasslands	Dry calcareous grasslands and steppes	Dry siliceous grasslands	Humid grasslands and tall herb communities	Mesophile grasslands	Overall threat level
Land drainage	1.0	1.8	1.0	2.4	2.4	**2.3**
Land claims for development	2.0	2.2	2.0	2.3	2.0	**2.2**
Agricultural abandonment	1.9	2.2	2.2	2.3	2.1	**2.2**
Agricultural improvement	2.3	2.0	1.9	2.3	2.2	**2.2**
Isolation and fragmentation of habitat	2.3	2.0	1.8	2.2	2.0	**2.1**
Felling / destruction of woodland	2.3	2.0	2.3	2.0	1.9	2.0
Afforestation of non-woodland habitats	2.2	2.0	2.6	1.9	1.8	2.0
Abandonment and change of woodland management	1.8	1.8	2.3	2.0	1.8	1.9
Built development (roads, housing, mining etc)	1.7	1.8	1.7	1.9	1.6	1.8
Recreational pressures and disturbance	1.9	1.6	1.5	1.9	1.8	1.8
Chemical pollution (herbicides and pesticides)	1.8	1.8	1.7	1.7	1.6	1.8
Natural ecological change (eg myxomatosis impacts)	1.9	1.6	1.5	1.8	1.6	1.7
Climate change	1.4	1.5	1.0	1.6	1.9	1.6
Collection (killing or taking)	1.8	1.2	1.0	1.4	1.5	1.4

Source: Wallis DeVries and Van Swaay (2009)

The impacts of agricultural abandonment in natural and semi-natural habitats

Recent assessments of agricultural drivers and likely land use changes suggest that significant amounts of agricultural abandonment are likely in the EU over the coming decades, possibly affecting 3-4 per cent of the total land area by 2030, which would amount to 126,000 – 168,000 km^2 (Keenleyside & Tucker, 2010). The potential biodiversity impacts of abandonment are therefore further examined here. As reviewed in the recent Land Services study for DG Environment (IEEP and Alterra, 2010) the impacts of abandonment on biodiversity vary according to complex interactions amongst the following factors:

- the biodiversity importance of the existing habitat and its associated species that will be lost as a result of abandonment;
- the potential short- to long-term biodiversity importance of the habitat and its associated species that will be gained as a result of abandonment ;
- the extent and proportion of the habitat types that will be lost and gained;
- the diversity of habitats within the landscape; and
- the degree of habitat fragmentation within the landscape (see 2.1.2).

Agricultural abandonment may therefore be beneficial for some sensitive natural habitats (such as blanket bogs) that are not dependent on agriculture to maintain their biodiversity value, and in some situations are detrimentally impacted by grazing, burning or other agricultural activities. It may also result in significant ecosystem services benefits. For example, the cessation of grazing and blocking of drains in blanket bogs in the UK could result in significant reductions in carbon losses that result from agriculture (Worrall and Evans, 2009).

Abandonment of agricultural semi-natural habitats may result in increases in species richness in some situations as, for example, observed in extensive grasslands in Hungary and alpine grasslands in Italy (Laiolo *et al,* 2004; Verhulst *et al,* 2004). A study of sub-alpine semi-natural hay meadows in Romania, found that abandonment led to the loss of some higher plant species, but other taxa groups benefited as ecological succession progressed (Baur *et al,* 2006). Moreover, there was no overall decline in proportion of red-listed or endemic species and in fact there was an increase in red-listed moths. Consequently, abandonment of patches of habitat can increase habitat and species diversity at a landscape scale (ie by creating opportunities for new communities to develop) and may help to restore ecological connectivity across fragmented landscapes.

In some specific situations large-scale abandonment might potentially provide opportunities for large-scale habitat regeneration (or pro-active restoration projects) that in the long-term might produce high value habitats. This would come at the detriment of some areas of valuable semi-natural agricultural habitats, but could help reverse forest habitat fragmentation, and its impacts on species (such as large carnivores) that require large tracts of such habitat (Taylor, 2011). Less fragmented forest habitats will also tend to be more resilient to climate change, and facilitate movements of species in response to changing climatic conditions (Huntley, 2007). Indeed, such opportunities have been recognised by some conservation organisations, which are investigating ways of maximising the benefits of such landuse changes[6]. In the right place planed abandonment could also contribute to the implementation of national ecological networks and the EU's expected Green Infrastructure strategy.

However, in many situations large-scale abandonment is likely to lead to declines in habitat heterogeneity and species diversity across the landscape, without major conservation benefits for highly threatened species. Furthermore, many of the habitats that will be gained from land abandonment will only be of moderate biodiversity value (at least for many tens if not hundreds of years) as they will be dominated by relatively common and generalist species. Many will be prone to invasive species. For example, due to recent declines in grazing livestock, 21 per cent of the protected grasslands in Hungary are invaded by invasive species like *Solidago* spp, *Ailanthus altissima*, *Elaeagnus angustifolia* and *Asclepias syriaca* (Stoate *et al,* 2009). In contrast many habitats of highest conservation concern in the EU are dependent on low intensity agricultural management for their existence (as listed in Annex 2.7, p256). Therefore as observed by Laiolo *et al* (2004) in the Alps, abandonment benefits may be at the expense of habitat loss of more specialist species that are of higher conservation concern. Indirect negative impacts may also result, such as from increasing cover for predators, or encouraging the spread of undesirable invasive species.

An indication of the potential impact of abandonment comes from an assessment of the habitat requirements of farmland birds by BirdLife International (involving a range of European farmland habitat experts). This revealed that some 28 species listed on Annex I of the Birds Directive are considered to be threatened by agricultural abandonment in semi-natural habitats and low intensity croplands in the EU (Table 7). Widespread abandonment of these habitats could therefore lead to regional extinctions. Similarly as noted in Table 6 agricultural abandonment is considered to be amongst the most significant threats to threatened butterflies in Europe (van Swaay *et al,* 2006; WallisDeVries and van Swaay, 2009).

In conclusion, whilst the biodiversity impacts of agricultural abandonment undoubtedly vary according to circumstances, in most situations large-scale abandonment of semi-natural habitats is likely to be significantly detrimental for biodiversity (eg Macdonald *et al,* 2000; Anon, 2005; Stoate *et al,* 2009).

Agricultural abandonment may also increase the risk of wildfires, particularly in hot and dry areas, at least during the early stages of succession before canopy closure increases humidity levels. Such fires can be especially severe as a result of the increased amounts of high levels of woody biomass, and result in significant soil damage and erosion, which may have long-term ecosystem impacts (FAO, 2011; Silva Mediterranea, 2010).

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[6] See eg www.wildeurope.org

Table 7: Bird species on Annex I of the Birds Directive that are considered to be potentially subject to high or critical impacts as a result of agricultural abandonment

Globally threatened species are highlighted in bold.
C = Critical: the species is likely to go extinct in the habitat in Europe within 20 years as a result of abandonment if current trends continue. H = High: the species population is likely to decline by >20% in the habitat in Europe within 20 years as a result of abandonment if current trends continue.

	Arable and improved grassland	Steppe habitat	Montane grassland	Wet grassland	Orchards and perennial crops	Pastoral woodlands
Black Stork (*Ciconia nigra*)						C
Red-breasted Goose (*Branta ruficollis*)	H					
Black-shouldered Kite (*Elanus caeruleus*)						H
Black Kite (Milvus migrans)						H
Red Kite (Milvus milvus)						H
Lammergeier (*Gypaetus barbatus*)			H			
Egyptian Vulture (*Neophron percnopterus*)			H			
Griffon Vulture (*Gyps fulvus*)			H			
Long-legged Buzzard (*Buteo rufinus*)		H				
Spanish Imperial Eagle (*Aquila adalberti*)						H
Imperial Eagle (*Aquila heliaca*)		H				
Lesser Kestrel (*Falco naumanni*)		H				
Saker Falcon (*Falco cherrug*)		H				
Rock Patridge (*Alectoris graeca*)			H			
Common Crane (*Grus grus*)						C
Great Bustard (*Otis tarda*)		H				
Great Snipe (*Gallinago media*)				H		
Pin-tailed Sandgrouse (*Pterocles orientalis*)		H				
Black-bellied Sandgrouse (*Pterocles alchata*)		H				
Roller (*Coracias garrulus*)					H	
Dupont's Lark (*Chersophilius duponti*)		H				
Short-toed Lark (*Calandrella brachydactyla*)		H				
Thekla Lark (*Galerida thekla*)					H	C
Woodlark (*Lullula arborea*)			H			H
Tawny Pipit (*Anthus campestris*)			H			
Aquatic warbler (*Acrocephalus paludicola*)				H		
Red-backed Shrike (*Lanius collurio*)					H	
Chough (*Pyrrhocorax pyrrhocorax*)			H			

Source: Tucker and Evans (1997). Assessments were based on the combined views of an expert habitat working group). Globally threat status as of September 2011 www.birdlife.org/datazone

2.5.2 Biodiversity trends and their causes in improved grasslands and cultivated crops

Impacts on birds

Recent changes in agricultural practices have had well documented and widespread significant impacts on farmland biodiversity in Europe (Stoate *et al,* 2009). Of these, perhaps the most obvious and best quantified in recent years have been declines in farmland bird populations (Donald *et al,* 2001; Donald *et al,* 2006). Due to the fact that birds are relatively well monitored in most EU Member States, farmland species have been have been used to develop a European Farmland Bird Indicator (EFBI), which primarily relates to common species of improved and intensive cultivated habitats. The index is one of the set of Streamlining European and Biodiversity Indicators (SEBI) that are used by the EEA to monitor the status of biodiversity in the EU. It is also used as a CMEF Impact Indicator to assess the biodiversity benefits of Member State Rural Development Programmes (RDPs). The EFBI provides an index of common farmland bird population changes in Europe which has shown an overall decline in their populations to about 50 per cent of their baseline 1980 level[7]. Although the trends before 1990, are less certain due to fewer data being available, the decline appears to have been particularly rapid up to about 1985. There is a suggestion from the combined data that the rate of decline may have decreased in recent years, but it is important to remember that these trends relate to common farmland birds and that population declines in rarer threatened farmland species (see Table 7) appear to be unabated and are therefore of particular concern (Birdlife International, 2004). National bird monitoring data confirm that the declining trends are relatively consistent across countries, but there are also some differences that reflect ecological and farming patterns, such as in Denmark (Fox, 2004).

The causes of declines in bird populations have been relatively well studied, especially in the UK over the last couple of decades. As a result, the key causes are reasonably well known and documented, and it is clear that most of them relate to changes in agricultural practices (Newton, 2004; Potts, 1986; Robinson and Sutherland, 2002; Wilson *et al,* 2009). These findings are broadly consistent with studies of the impacts of agricultural practices on farmland birds elsewhere in Europe, according to reviews by (Báldi and Batáry, 2011; Bota *et al,* 2005; Donald *et al,* 2001; Pain & Pienkowski, 1997; Stoate *et al,* 2009; Tucker & Evans, 1997). There are of course regional variations in biodiversity trends and their causes, but the studies suggest that the main causes of the declines of farmland birds in improved grasslands and cropland habitats in Europe result from further agricultural improvement, intensification and specialisation.

It is important to note that the impacts of agricultural changes on birds are likely to have been less severe than in other taxa, as many species are generalists that are relatively resilient to environmental changes. European-wide monitoring data on plants and other taxa groups are not available, but various national studies consistently show very high rates of decline in species diversity in improved grassland and intensively cultivated farmland habitats (see summaries of example studies in Box 2). There is also some evidence that impacts, similar to those on birds from agricultural improvement, intensification and specialisation, have occurred across a range of taxa groups and it seems clear that in general, biodiversity value (eg the diversity and abundance of characteristic species) declines with increasing agricultural improvement and intensification (Aebischer, 1991; Andreasen and Streibig, 2011; Billeter *et al,* 2008; Donald, 1998; Hendrickx *et al,* 2007; José-María *et al,* 2010; Kovács-Hostyánszki *et al,* 2011a; Kovács-Hostyánszki *et al,* 2011b; Le Féon *et al,* 2010; Sutcliffe and Kay, 2000; van Swaay *et al,* 2006).

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[7] http://www.eea.europa.eu/data-and-maps/indicators/abundance-and-distribution-of-selected-species/abundance-and-distribution-of-selected

Although impacts vary across taxa and according to their context (eg specific habitat type and location) evidence strongly indicates that changes in the following agricultural management practices as a result of agricultural improvements, intensification and specialisation, have the most important ecological impacts on species (as described in Annex 2.1 (p227):

- Use of fertilisers, which results in fast growing and dense grasslands and crops that provide poor breeding and feeding habitats, as well as reducing plant species diversity and associated animal communities.
- Ploughing and re-seeding of grasslands with grass cultivars, which further reduces plant species diversity (and associated animal communities), increases the density and growth rates of the grassland, and impacts soil biodiversity.
- High grazing densities, above the carrying capacity of the land, which reduces plant species and structural diversity in pastures, and the abundance and diversity of associated animal communities; as well causing high losses of ground nesting birds.
- Cutting for silage, which results in the loss of species-rich hay meadows (where practised) and high losses of ground nesting birds and other animals.
- Use of herbicides (and other forms of weed control), which further reduces plant species diversity in grasslands and crops (and associated animal communities).
- Use of pesticides, which reduces the abundance and diversity of invertebrate food resources for invertebrate predators (eg other invertebrates, birds and bats etc).
- Crop specialisation and reduced crop rotations, which reduces structural and ecological heterogeneity in the landscape resulting in reduced breeding and feeding options, and reduced ecological connectivity amongst habitat patches.
- Changes in timing of agricultural practices, such as crop sowing, which, for example, affects the availability of over winter food and suitable vegetation (in terms of height and density) for breeding.
- Removal of boundary habitats (such as hedgerows, stone terraces and ditches) and other non-farmed habitats (woodlots, trees and ponds), which reduces habitat diversity and connectivity amongst non-farmed habitat patches in the farmed landscape.

Other agricultural related contributory causes include increased mechanisation/efficiency of cropping (eg leading to less spilt grain) and high predation rates as a result of high levels of disturbance (which expose nests to predation and interfere with predator defence behaviours).

It should be borne in mind that other factors that are not directly related to agriculture are also contributors to biodiversity changes in farmland habitats, such as high predator densities, alien invasive species, hunting, disturbance, collisions with vehicles and power lines etc, external pollution sources, impacts on species whilst on migration, or in wintering or breeding grounds, and climate change (see further discussion on factors affecting the success of agri-environment measures in Chapter 5). However, evidence suggests that agricultural factors have the most significant impact on population trends in most farmland specialist species, especially those of improved grasslands and intensive crops.

Modelling studies based on the ecological traits of species have been used to quantify the risks and impacts from changes in agricultural practices on UK farmland birds (Butler *et al,* 2007a; Butler *et al,* 2007b) and farmland birds Europe (Butler *et al,* 2010). These studies are described further in Annex 2.9 (p278). The UK study found that declines in farmland birds in the UK could be largely explained by factors that affect summer and winter food availability and nesting habitat, specifically six key components of agricultural intensification: the switch from spring to autumn sowing, increased agrochemical inputs, loss of non-cropped habitats, land drainage, the switch from hay to silage and the increased intensity of grassland management. The results of the analysis indicated that species that were considered to be at high risk of experiencing impacts on food and nesting resources from these changes were more likely to have declining farmland populations (and be listed as threatened in the UK). Furthermore, for most species the most significant risks were associated with changes in the in-field components of farmland habitats, rather than within hedgerows and margins.

The European analysis (Butler *et al,* 2010) extended the modelling approach to Europe and 54 common farmland bird species, and assessed the same six intensification components as those in the 2007 UK study, with the addition of the risks associated with the loss of semi-natural grasslands and afforestation. This strongly suggests that changes in food resource availability and, to a lesser extent, suitable nesting sites within the cropped area of agricultural landscapes are the cause of declines in EU populations of most common farmland bird species. As in the 2007 UK study, there was a significant negative relationship between estimated risk scores for species and their observed population trends.

The UK bird trait-based modelling work described above was also extended to other key taxa in the UK (Butler *et al,* 2009). This assessed the risks associated with the same six intensification components considered in the 2007 UK bird study and drew similar conclusions concerning the impacts of agricultural improvement, intensification and specialisation. It is also suggested that the populations of two-thirds of 333 plant and animal species assessed are unsustainable under current UK agricultural practices.

2.5.3 Permanent crops

It is very difficult to assess the impacts of agricultural changes on biodiversity within permanent crops as these habitats and their associated species are not well or specifically monitored. Many of their species are widely distributed generalist species, and therefore it is difficult to identify suitable biodiversity indicators that are specific to the habitat. The situation is further complicated for birds, which are normally the most widely monitored species, by the fact that a high proportion of the species that use permanent crops are migratory and use the habitat for breeding or during the winter. Trends in these species cannot therefore easily distinguish between impacts in permanent crops and other habitats used during their annual cycle.

However, on the basis of the current understanding of the ecological needs of birds and many other species of permanent crops (see Section 2.3.4), and indications of trends of intensification of permanent cropping systems as well as abandonment, it is likely that significant detrimental biodiversity impacts are occurring.

Box 2: Representative examples of studies of trends in taxa groups, other than birds, in intensive and improved farmland habitats in the EU

Arable farmland plants - Britain

A review of trends in plant species associated with arable farmland in Britain showed that 50-60% of species showed significant decreases in range between 1960 and 1990/2000 (Robinson & Sutherland, 2002). Many farmland plants contracted markedly in range through the 1950s and 1960s, particularly arable weeds. A small number of weed species that are particularly difficult to control have increased in abundance.

Smart *et al* (2000) analysed the abundance of food plants for butterfly larvae in 1978 and 1990 on lowland arable and pasture farmland. The majority of increasing butterfly species had *Elytrigia repens* or *Urtica dioica* as food plants, both of which increased in cover and frequency. The four decreasing butterfly species that were examined were dependant on more decreasing plant species than increasing plant species, principally plants dependant on extensive grassland.

Bumblebees and hoverflies – Britain and Netherlands
Biesmeijer *et al* (2006) found evidence of declines in local bee diversity in Britain and the Netherlands (pre- versus post-1980); however, divergent trends were observed in hoverflies.

Other invertebrates associated with farmland – Britain
A review of trends in invertebrate species associated with arable farmland in Britain showed declines in carabid and aphid species in cereal fields (Robinson & Sutherland, 2002). A study that compared a 27-year data series of aerial insects in a rural location in Scotland found significant linkages between insect abundance and local farmland management, indicating that there were more arthropods when farming was less intense, and when there were large areas of spring-sown barley (Benton *et al,* 2002)). Some specialist farmland bird species tracked the arthropod increases with a lag of one year. The 15 arthropod groups showed different marked waves of increases and decreases in abundance over the 27 years, related to climate and agricultural practices.

Mammals
Brown hare (*Lepus europaeus*) populations declined between the 1960s and 1980s both in Britain and elsewhere in Europe (Robinson & Sutherland, 2002) and populations continue to decline in most areas where conservation measures have not been taken (Zellweger-Fischer *et al,* 2011). Another threatened species is the European Hamster (*Cricetus cricetus*), which has been nearly extinct in many regions of Europe , mainly of the western distribution range in the Netherlands, Belgium, Germany and France and most recently in Poland and the Czech Republic in Central Europe (Ziomek and Banaszek, 2007).

British plants
British plant censuses in 1954-60 and 1987-99 covering over 98% of British 10-km squares showed that 28% of native plant species decreased in Britain since the 1950s, particularly on intensively used farmland (Thomas *et al,* 2004)).

Common arable weeds – Denmark
Danish weed surveys have been carried out in 1967-1970, 1987-1989 and 2001-2004 just before harvest in the most common crops in Denmark. A tripling in the use of lime since 1950 has had a severe impact on calcifuge weed species. Winter annual species have shown marked increases, corresponding to the shift to dominance of winter-sown crops over spring-sown crops and grass leys. New crops such as maize have introduced some new weed species to Denmark. From 1987 a group of 68 weed species showed an average increase of 44-68% in cereals, in response to a reduction in herbicide applications from a 90% efficacy rate to a 75% efficacy rate (Andreasen and Streibig, 2011).

2.6 Future prospects for biodiversity in agricultural habitats in the EU

2.6.1 Driving forces affecting agriculture and the rural economy

A variety of factors will act on the development of agriculture in the EU in the next 20 years, and these can be expected to have a range of positive and negative influences on biodiversity. In particular:

- **Growth in demand for food and energy crops** is expected to increase EU production and encourage further intensification and specialisation, particularly in the new Member States. The viability of some HNV farming systems may be enhanced, while others will be threatened by increased competition from imports as well as social changes in rural areas, or face pressure from intensification or changes in land use. In addition, biodiversity in the generality of the farmed countryside, outside HNV areas, appears likely to decline in these Member States.
- **Climate change** will affect land use and agricultural management and impact on biodiversity, though the effects on biodiversity are complex and varied.
- **Technological development** is expected to continue to enhance productivity. It may have negative effects on biodiversity by driving intensification and specialisation, while in other areas contributing to more sustainable farming practices.
- **Demographic change** may exacerbate rural decline and abandonment in the most remote areas of the EU, whilst offering a mix of positive and negative impacts in peri-urban and accessible areas where counter-urbanisation increases.

Again, it is clear that these drivers will impact in different ways in different regions of the EU, presenting threats for biodiversity in some areas and opportunities in others.

The combined effects on the agricultural sector of changes in these drivers, as well as developments in the CAP and other policies, have been modelled through EU studies examining future scenarios for agriculture and the rural economy, such as Scenar 2020 (Nowicki *et al,* 2009) and Eururalis (Rienks *et al,* 2008). These forecast the following changes of relevance to biodiversity:

- Agriculture will account for a reduced share – 40 per cent - of EU land use;
- An increase in production of food and energy crops, driven by technological change
- Declining production of livestock, especially beef, as a result of trade liberalisation
- Declining agricultural employment, especially in the new Member States
- Abandonment of marginal areas with southern, eastern and northern countries of the EU most affected;
- Declining farm incomes, especially as a result of cuts in direct payments;

- Effects of pillar 2 increasing productivity (farm investments), diversification, and extensification (agri-environment);
- Decline in the number of farm holdings by 25 per cent in EU15 and 40 per cent in EU12;
- A continuing specialisation (in open-field arable, horticultural and livestock-rearing/dairy systems) and on the other hand, a continuing role for extensive livestock-based systems with mixed cropping for fodder and fallow land.
- Continuing urbanisation in peri-urban regions.

2.6.2 Likely impacts of future agricultural change on biodiversity

The trends outlined above are likely to have mixed implications for biodiversity. The rate of biodiversity loss in improved and intensive systems in the EU-15 may decline because intensification appears to be levelling off. Although fertiliser use varies considerably, applications rates are declining in many areas as a result of price increases and better targeting of inputs. Similarly with modern crop protection approaches, pesticides tend to be used at lower rates and less frequently, for example in response to pest outbreaks rather than prophylactically. Ploughing is also being gradually replaced by reduced tillage techniques in some farming systems and areas. Nevertheless, traditional ploughing remains the norm in most conventional arable systems.

Of particular concern is the likelihood that significant further intensification of improved grasslands and croplands is likely to take place in the EU-12 Member States, especially the Baltic States, because there is considerable scope for further farm investment, restructuring and technological improvement in the region. At the same time, as described in Section 2.5.1, significant areas of semi-natural habitats and other HNV farmland areas in the EU-12 (and parts of southern Europe) are expected to become increasingly vulnerable to land abandonment, especially in lagging areas. Both intensification and abandonment will have substantial biodiversity impacts as many of Europe's most threatened agricultural habitats and species remain in these regions, mainly as a result of their lower intensity farming.

The trait-based modelling study of European farmland birds by Butler *et al* (2010), as described above and in Annex 2.9 (p278), investigated the potential impacts of four land use and policy scenarios on the European Farmland Bird Indicator (EFBI) in 2020. According to Scenario 1, which was a baseline scenario under which current conditions persist, the EFBI is expected to fall by 23 per cent compared to the 2005 level. The remaining three scenarios introduced further risks to birds in addition to those considered in Scenario 1. Scenario 2 examined the loss of compulsory set-aside (which has subsequently occurred) and predicted that the EFBI in 2020 would be 8 per cent lower than under the baseline Scenario 1. Scenario 3 examined accelerated agricultural intensification in east Europe, which predicted a large detrimental impact on the EFBI, with 2020 levels expected to be between 20 per cent and 25 per cent lower than baseline Scenario 1. Scenario 4 investigated the impacts of the abandonment of 5 per cent, 10 per cent and 15 per cent of UAA, the results of which suggest that each 5 per cent decline in the UAA would lead to a 2–2.5 per cent reduction in the EFBI by 2020 compared to the baseline scenario.

Although there is some uncertainty in the models, the results clearly indicate that further substantial declines in farmland bird populations (and by implication, probably other taxa groups) are likely, unless large-scale effective mitigation measures are implemented (see below). Further trait-based modelling was therefore commissioned as part of this study to investigate the potential benefits for EU bird populations of mitigation measures in improved and intensive agricultural habitats (see Annex 2.9 (p278) for a detailed account of the scenarios and analysis). The mitigation measures assessed considered the impacts of placing 5 per cent or 10 per cent of land under conservation management, with various proportions allocated to in-field, margin and hedgerow related measures. Under each conservation measure scenario the predicted EFBI was higher than if current conditions persist (ie under Scenario 1), but most importantly, allocating more land and targeting efforts towards resource delivery in the cropped area had the greatest benefit. The best predicted outcome would occur if 10 per cent land was allocated to beneficial cropped area management for all three resource types (ie summer and winter food and nesting habitat), resulting in the EFBI in 2035 being 7 per cent higher than if current conditions persist. However, whilst all scenarios were favourable compared to Scenario 1, most benefits were slight and none was sufficient to halt farmland bird declines. This suggests that the allocation of more than 10 per cent of land to biodiversity focussed management measures may be required to halt further declines of the EFBI. However, this result is based on the assumption that risk reduction is proportional to land allocated to conservation measures. Under simple generic schemes this assumption may be realistic. But studies in the UK suggest that the use of well designed efficient tailored mitigation measures that require small areas of land (eg planting of seed crops for birds), when combined with appropriate targeting, may be able to significantly reduce the total land area required to meet biodiversity conservation targets (Hart *et al,* 2011a; Winspear *et al,* 2010).

Lastly, it is important to note that fragmentation from urbanisation and infrastructure developments, as well as climate change will exacerbate all expected pressures on agricultural habitats and species (IEEP and Alterra, 2010). It is therefore clear that arresting and reversing biodiversity losses in EU agricultural habitats, and the achievement of EU environmental policies and targets, will be a major challenge.

3 EU POLICY MEASURES FOR THE DELIVERY OF BIODIVERSITY THROUGH AGRICULTURE

This chapter presents the range of policy measures, both within and outside the CAP, that have been adopted as a policy response to promote the delivery of biodiversity through agriculture. This includes both regulatory responses as well as support provided to farmers and other land managers to encourage management practices compatible with biodiversity. The CAP continues to be the most significant funding instrument that can influence agricultural management, both in terms of the size of budget and geographical coverage and therefore it is the CAP measures, both those in Pillar 1 (market and income support) and Pillar 2 (rural development) of the CAP, which form the main focus of the chapter.

In investigating the impacts and effectiveness of different policy measures, the chapter considers the range of schemes and management options[8] that are being promoted in natural, semi-natural and improved habitats. It proceeds to explore the different ways in which they are implemented in different parts of Europe, the interactions and complementarities between different policy measures in each habitat type and the effectiveness of the measures in delivering their biodiversity objectives.

3.1 Identifying policy measures for the delivery of biodiversity through agriculture

Awareness of the environmental dimension of agricultural activity and the political weight attached to addressing this agenda has increased significantly over the past three decades. Addressing biodiversity concerns within the agricultural sector is one element of a more strategic goal to increase the integrity and health of the farmed environment more generally. Maintaining and enhancing biodiversity has been one of the key priorities to be

[8] The term 'agri-environment measure' refers to a rural development instrument (code 214) included in the Regulation 1698/2004. By contrast, the term 'agri-environment scheme' (in a number of Rural Development Programmes (RDPs) and in some literature called 'sub-measure') is used in this study in the sense of a national or regional scheme designed to deliver a specifically targeted agri-environmental management, such as for example a scheme for protecting the little bustard (*Tetrax tetrax*) in France. Another term 'management option' is used in this study for a specific management, such as the introduction of in-field plots of grass, or field edge management, implemented alongside other management options within the *Tetrax tetrax* scheme. In all RDPs, a whole range of agri-environment schemes are offered under the agri-environment measure and each scheme typically requires the use of several different 'management options' under one voluntary contract.

addressed by environmental measures within the CAP ever since they were introduced in the 1980s. To date, the focus has been predominantly on measures that aim to influence agricultural land management practices, specifically through use of the agri-environment measure, the only policy measure in Pillar 2 that is compulsory for all Member States to implement, but also more recently through the introduction of cross compliance. However, despite this, concerns remain about the state of biodiversity in the EU, with declines of certain species and habitats still occurring, albeit at a lesser rate than would have been the case without the policy instruments in place. Indeed, policy reviews under the Agenda 2000 reform in 1999, the Fischler reforms in 2003 and 2004 and the Health Check in 2008 all highlighted the need to enhance the delivery of environmental objectives through agriculture, including the preservation of biodiversity and to reduce the on-going degradation of habitats and decline in species populations (Baldock *et al,* 2002; OECD, 2011).

However, the CAP is not the only policy instrument that has the potential to influence biodiversity provision related to agriculture. A broad range of EU policy instruments are available, within and outside the CAP that can contribute to the delivery of the EU's biodiversity targets through agriculture. These include:

- Legislative measures which place binding requirements on farmers (for example, the EU Birds[9] and Habitats Directives[10], the Nitrates Directive[11], the Framework Directive on Sustainable Use of Pesticides, the Water Framework Directive[12], aspects of the EIA Directive[13], as well as the Environmental Liability Directive[14] and certain aspects of the Renewable Energy Directive[15];

- CAP measures including:
    - Pillar 1 measures such as cross compliance, including standards of Good Agriculture and Environmental Condition (GAEC) as well as certain aspects of Article 68 specific support;
    - Pillar 2 measures that promote particular land management practices, such as the agri-environment measure, including organic farming support; other land based measures such as Natura2000 and Less Favoured Area (LFA)

[9] Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds, Official Journal L20/7, 26.1.2010.

[10] Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora, Official Journal L 206, 22.07.1992.

[11] Directive 91/976/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources, Official Journal L 375, 31.12.1991.

[12] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community Action in the field of water policy, Official Journal L 327/1, 22.12.2000.

[13] 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, Official Journal L 073, 14.03.1997.

[14] Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage.

[15] Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC.

payments and the non-productive investments used in conjunction with land management measures;
    - Other Pillar 1 measures, including obligations for Member States to set up the Farm Advisory System;
    - Other Pillar 2 measures to develop the skills and capacity of farmers by promoting training, advice, extension services and dissemination of information; to enhance farm modernisation and the economic viability of farms and rural areas; and to support local participation (the Leader approach);

- Other CAP measures, including voluntary measures for producers to register products in the EU food quality schemes; voluntary measures provided in the National frameworks to support environmental actions in the fruit and vegetable sector; and measures to support the conservation of genetic resources for plants, trees and animals;

- Public payments influencing land management under other EU policies, for example LIFE+ or the Structural Funds; and

- National policies, voluntary approaches and market based measures.

Not all the measures with the potential to deliver biodiversity benefits set this out as their core objective. In determining which measures have the highest potential to deliver biodiversity outcomes, we have therefore taken into account their objectives and their potential outcomes. An examination of the intervention logics of individual measures has allowed the policy measures for the delivery of biodiversity benefits to be divided into those that are 'focussed directly' on achieving biodiversity objectives, those that have a 'partial focus' on biodiversity, and those that have 'no direct focus but have the potential to have a positive impact on biodiversity', following the approach taken by Cooper *et al* (2009). In this categorisation, we have taken into account of both the observed and the potential effect of measures.

Policy measures with a **direct focus** on biodiversity set out the conservation of biodiversity and habitats as their main goal. The agri-environment measure and the accompanying non-productive investment measure are the key CAP measures in this group. Some cross compliance GAEC standards, elements of the Pillar 1 Article 68 measure and some other EU policy measures (such as LIFE+) and national or voluntary initiatives also sit here (see Table 8).

Measures with a **partial focus** on biodiversity are classed as those whose primary aim is to support other economic or social goals, but the secondary objectives stated in their intervention logics allows them to be used to deliver environmental benefits. An example is the farm modernisation measure whose principal aim is to improve the competitiveness of the farm business, but some of its actions such as capital investments for improving manure storage have the potential to deliver benefits for water quality with knock-on beneficial effects for biodiversity. Another example of measures that are 'partially' focussed on biodiversity includes measures, such as those that promote the provision of training and advice.

Finally, there is a group of measures which have **no direct focus on biodiversity, but have the potential to have a positive impact,** depending on their use. Within the CAP, Pillar 1 direct payments fall into this category. While they are designed to deliver generic income support to farmers and land managers, they can have site-specific beneficial impacts on biodiversity, for example, through preventing land abandonment in 'lagging areas' and other farmland situations with serious socio-economic challenges.

Table 8 illustrates the degree of focus on biodiversity of a range of CAP measures. Their impact and effectiveness in achieving biodiversity benefits are examined in the sections that follow. Legislative measures outside the CAP are treated separately in the next section.

To be able to appreciate whether, and to what extent, these measures deliver biodiversity benefits on the ground, we need to be aware that they operate in different ways. There are measures that have a universal character, applying to all farmers across the EU-27, such as Pillar 1 direct payments and others that are not universally applied, whose biodiversity impact will depend *inter alia* on the level of uptake by farmers, even though many of these measures may be widely available and have simple requirements (for example Pillar 2 measures such a training and advisory measures or basic management under the agri-environment measure). Voluntary approaches are characteristic predominantly for Pillar 2, however, some measures under Pillar 1 are also voluntary, such as the Article 68 'special support' measure, the use of the Farm Advisory System or the environmental measures in the fruit and vegetable sector. In addition, the way in which these measures are designed, targeted, implemented, their spatial reach across landscapes, plus the degree to which they are sufficiently financed, all have an impact on the degree to which they have the potential to deliver biodiversity. Some of these aspects are considered in more depth in Chapter 4.

Given the diverse nature of biodiversity, not only measures with a universal or general application within the CAP are needed, but also a more nuanced policy response is required, using a carefully designed array of management options that respond to the ecological needs and policy priorities that vary between different locations. In particular, land based measures have to accommodate an array of management options to be sufficiently flexible to address these varying needs. For the policy to be most effective, the use of other CAP measures, for example training and advice, will inevitably need to vary between and within regions too, depending on the nature of the farming system and the pressures facing biodiversity locally. Therefore the mix of policy instruments available needs to be flexible enough to address common issues, for example reducing external impacts on biodiversity (such as avoiding insecticides which have similar impacts everywhere) as well as to focus on designing, tailoring and targeting land management to local biodiversity needs.

Table 8: CAP measures used for the delivery of biodiversity benefits

Measures with a DIRECT FOCUS on the provision of biodiversity and habitats and ecosystem services		
Pillar 2	Rural Development[1]	Agri-Environment (214) Non-Productive investments (216)
Pillar 1	Cross compliance - GAEC standards[2]	Compulsory GAEC standards for: • The retention of landscape features; • The protection of permanent pasture; • Avoiding the encroachment of unwanted vegetation on agricultural land; and, • (From 2012) the establishment of buffer strips along watercourses. Optional GAEC standards for: • Minimum stocking rates or appropriate regimes; and, • (From 2010) establishment or retention of habitats.
	Cross compliance[2]	Permanent Pasture quantitative requirements under Article 6(2).
	Article 68[2]	Special support for: • Specific types of farming which are important for the protection of the environment - Art. 68 (1)(a)(i); and, • Specific agricultural activities entailing additional agri-environment benefits - Art. 68 (1)(a)(v).
Other CAP measures	SAPARD[3] and IPARD[4]	Agri-environment (214)
	Community Programme for the genetic resources in agriculture[5]	Actions to support conservation of genetic resources for plants, trees and animals.
	National frameworks for environmental measures in the fruit and vegetable sector[6]	Actions directly aimed at protection of biodiversity and habitats (for example, maintenance of unfarmed margins; maintenance of landscape features; use of local crop varieties; etc)*.
	Organic farming[7]	Actions aimed at maintenance and enhancement of soil, soil stability and soil biodiversity.

Notes:

1. Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).
2. Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers.
3. Council Regulation (EC) No 1268/1999 of 21 June 1999 on Community support for pre-accession measures for agriculture and rural development in the applicant countries of central and eastern Europe in the pre-accession period.
4. Article 12 of Council Regulation (EC) No 1085/2006 of 17 July 2006 establishing an Instrument for Pre-Accession Assistance (IPA).
5. Council Regulation (EC) No 870/2004 of 24 April 2004 establishing a Community programme on the conservation, characterisation, collection and utilisation of genetic resources in agriculture.
6. Council Regulation (EC) No 1182/2007 of 26 September 2007 laying down specific rules as regards the fruit and vegetable sector.
7. Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91

Measures with a PARTIAL FOCUS on the provision of biodiversity and habitats and ecosystem services		
Pillar 2	Rural Development	• Advice, training and information measures (111, 114, 115, 331); • Farm modernisation (121); • LFA measures (211, 212); • Natura 2000 (213)*; • First afforestation of agricultural land (221); • First establishment of agro-forestry systems on agricultural land (222); • Conservation and upgrading of the rural heritage (323); and, • LEADER (411, 412, 413).
Other CAP measures	National frameworks for environmental measures in the fruit and vegetable sector	Actions indirectly aimed at protection of biodiversity and habitats (eg integrated production; integrated pest management; alternative plant protection)**.
	Farm Advisory System[2]	Obligations under Article 12 and 13.
Measures with NO DIRECT FOCUS but that may have a positive impact on the preservation of biodiversity and ecosystem services		
Pillar 2	Rural Development	• Adding value to agricultural products (123); • Infrastructure development (125); • Diversification into non-agricultural activities (311); • Support for the creation and development of micro-enterprises (312); • Encouragement of tourism activities (313); and, • Village renewal and development (321).
Pillar 1	Decoupled direct payments	Payments to stabilise farm incomes
	Cross compliance - GAEC standards	GAEC standards focussing on: maintaining soil functionality or protection and management of water.
	Article 68	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).

Notes:

* Natura2000 measure has been classified as having only a partial focus on biodiversity following the methodology developed in Cooper *et al* (2009). In the intervention logic of the measure, compensation is provided for an area-specific disadvantage, due to having to comply with prescriptions specified in N2000 management plans or set via other rules. This is why the measure is in the first place an income support measure.

**The measures directly focussed on biodiversity under National Frameworks for fruit and vegetable sector have a relatively limited potential due to having been included in frameworks by no more than two Member States in 2010, while only one Member State started implementing them in 2010.

An overview of majority of the management options that are involved in the range of the CAP policy measures for delivery of biodiversity across the EU are set out in Table 9. The information has been distilled from a review of Rural Development Programmes (RDPs) for the 2007-2013 programming period, the cross compliance GAEC standards in case study countries and other relevant policy documents. The potential on-farm impacts of individual management options have been assessed on the basis of literature and evidence of their real effects on the ground.

Table 9: Potential on-farm biodiversity impacts of a range of management options available within the CAP (Pillar 1 and Pillar 2)

Management Option (MO)	Potential on-farm Impacts on Biodiversity	CAP measure	
		Pillar 1	Pillar 2
Grazed natural and semi-natural habitats and improved grasslands			
Actions for grassland management			
Cutting regime Maintaining permanent pasture Restricted management dates Scrub management Continuation of traditional management practices Grazing regime	●●	GAEC, Art 68	211 and 212*, 213, 214
Actions to reduce nutrient leaching from soils			
Buffer Strips Manure management	●	GAEC, SMR, Art 68	213, 214
Actions to maintain landscape and historic features			
Establishment of landscape features Management of landscape features Historic feature management	●●	GAEC, Art 68	213, 214, 216
Actions for the management of water resources			
Management of water resources Improvement in manure handling/processing/storage equipment Improvement to new livestock housing	●	SMR	121, 125, 323
Actions to reduce inputs applied to grassland			
Buffer Strips Integrated management Limits to fertiliser application Limits to plant protection products application	●●	GAEC, SMR, Art 68	213, 214
Cultivated croplands (including temporary grasslands and other fodder crops)			
Actions for on-going management of extensive arable			
Continuation of traditional management practices (mosaic-like small-parcel cropping) Continuation of traditional grazing of crop residues	●●	GAEC, Art 68	211 and 212*, 213, 214
Actions to create wildlife conservation areas in more productive systems			
Buffer Strips Restrictions on the cultivated area	●●	GAEC, Art 68 SMR (for	213, 214 125, 216, 323

Fallow: whole field Fallow: zones, skylark plots Specified seed regime Wildlife strips, field margins, beetle banks Provision of winter food for birds, stubble management Habitat management Habitat re-creation Habitat restoration		buffer strips and habitats)	(for habitat restoration)
Actions to maintain landscape and historic features			
Establishment of landscape features Management of landscape features Historic feature management	●●	GAEC, Art 68	213, 214
Actions for the diversification and rotation of crops			
Rotation with fallow Rotation with legumes	●●	GAEC, Art 68, SMR	213, 214
Actions to reduce leaching from soils			
Buffer Strips Green cover (over-winter crops, catch crops) Manure management Spring cultivation Spray restrictions	●	GAEC, Art 68, SMR	213, 214
Actions to maintain soil structure			
Arable reversion Drilling regime Harvesting regime Stubble management Tillage regime	●	Art 68	213, 214
Actions to reduce inputs applied to land			
Buffer strips Biological pest control Integrated management Restrictions on the cultivated area Limits to fertiliser application Limits to plant protection products application Manual/mechanical weed control	●	GAEC, SMR, Art 68, Fruit&veg	213, 214
Actions for the management of water resources			
Management of water levels Improved irrigation system technologies Irrigation management Improvement in manure handling	●	Art 68	213, 214 121 (for capital investments)
Permanent croplands			
Actions for on-going management of permanent crops			
Maintaining traditional orchards (management and protection of trees/vines) Continuation of traditional grazing Tree maintenance (pruning, avoidance of root ploughing) Specified density and/or number of trees Management of permanent crop ground conditions Harvesting regime	●●	Art 68 GAEC (for continuation of grazing)	213, 214, 216 211 and 212* (for continuation of grazing)
Actions to reduce inputs applied to land			

Biological pest control Integrated management Limits to fertiliser application Limits to plant protection products application	●	GAEC, SMR, Art 68, Fruit&veg	213, 214
Generic management options			
Actions for re-creation and restoration of degraded habitats			
Habitat re-creation and restoration (eg wetlands) Habitat management (eg wetlands, traditional biotopes)	●●	GAEC (optional)	125, 216, 323 (for capital investments) 213, 214 (for management)
Organic management			
Organic conversion Organic management	●●	Art 68	214
Genetic conservation			
Genetic conservation (rare or threatened animals) Genetic conservation(rare or threatened crop species) Genetic conservation (rare or threatened tree varieties)	●●	Art 68, CPCGR, Fruit&veg	213, 214
Actions to preserve pollinators			
Apiculture for pollination	●●	Art 68	214
First afforestation of agricultural land			
First afforestation Agroforestry	**v**		221 222

Source: IEEP own screening of RDPs, scientific literature, expert judgement.
Key: Positive impact on biodiversity: ●● = direct; ● indirect; **v** = variable (ie depending on how and where it is applied).
Notes:
* Management requirements can be included in the compensation measures for 'less-favoured areas' (211 and 212)
CPCGRs - Community programme for conservation of genetic resources.
Fruit&Veg – National Frameworks for environmental measures in the fruit and vegetable sector

Having identified the relevant policy measures that have the potential to improve the provision of biodiversity through agriculture both within and outside the CAP, the sections that follow explore their impact and effectiveness in more detail. The sections follow the categorisation of measures with a 'direct', a 'partial' focus and with 'no direct focus but a potential positive impact'.

Legislative measures are considered first, as they provide the context within which the CAP measures operate (see Section 3.1). Those Pillar 2 measures that are most directly focussed on biodiversity within the CAP and have the largest potential as well as observed impact on the delivery of biodiversity are examined in Section 3.2, followed by other Pillar 2 measures. Section 3.4 proceeds to examine the effectiveness of Pillar 1 measures with a focus on biodiversity. It considers cross-compliance measures as setting out the legislative baseline for the delivery of basic biodiversity on agricultural land, as well as considering the role of direct payments and eligibility issues associated with direct payments that have impact on biodiversity on the ground. The specific case of the old set-aside measure is then explored as an illustration of a policy measure that is in the process of being re-designed with a new focus. The chapter concludes with a brief review of the impact and effectiveness of other EU policies and other national, voluntary and market based approaches on biodiversity.

3.2 Effectiveness of legislative measures for delivery of farmland biodiversity

There are a number of EU legislative requirements in place that impact upon biodiversity on agricultural land. These measures are an important part of the policy response to address biodiversity objectives. These stipulate the extent of legal obligations that apply to the management of the biodiversity resource and the management of land, by articulating both the individual property rights and societal expectations regarding practices that are considered good stewardship of the biodiversity resource base (Bromley, 1997). A detailed overview of all the legislative measures affecting agricultural management is set out in Annex 3 (p298). The following sections briefly identify the key measures and discuss their effectiveness in delivering biodiversity on the ground.

Within the suite of legislative measures with a **direct focus** on biodiversity, the measures under the Birds and Habitats Directives, as well as certain aspects of the Environmental Liability Directive, affect agricultural practices most directly. Within the legislative measures that have **no direct focus** on biodiversity but can have a beneficial impact on biodiversity, provisions applied through, for example, the Nitrates Directive, the Framework Directive on Sustainable Use of Pesticides, the Water Framework Directive, the EIA Directive and the IPPC Directive are particularly relevant (see Annex Table 8).

The actions legally required at the farm level are often also required as part of the CAP cross-compliance requirements. These legislative requirements provide an important foundation on which more demanding management, supported through other policy measures, can build. For this to happen, effective implementation of the requirements set out in EU Directives is needed. For example, the success of agri-environment schemes depends critically on the effective implementation of environmental legislation across the EU. If the basic requirements stipulated in the legislation are not in place, for whatever reason, then it will be difficult to implement effectively more demanding management through CAP voluntary measures.

The **EU Birds Directive (BD) and Habitats Directive (HD)** includes a range of requirements, some of which are the responsibility of Member States, and some of which are directly binding on farmers and land managers. Particularly important at the farm level are the requirements for the upkeep and management of biotopes and habitats (Art 3(2)(b) of BD); special conservation measures for the protection of the listed species, migratory species and for avoidance of the deterioration of habitats (Art 4(1), (2) and (4) of BD); the requirements for the protection of birds and their breeding and nesting places (Art 5(a), (b) and (d) of BD); and for the protection of rare plants (Art 13(1)(a) of HD). In addition, other requirements under these Directives, may put additional constraints on farmers in Natura 2000 sites and management for delivering the ecological coherence between these sites (Art 3(2)(b), 4(1) of BD and 6 of HD). All these measures are included in cross compliance requirements under the CAP, meaning that farmers not observing these provisions are at risk of losing direct payments. Further discussion of cross compliance is provided in the section below.

Other legislative requirements set out in the Birds and Habitats Directives are binding directly on the Member State rather than the farmer and are not appropriate to be included within cross-compliance obligations. However, they may have consequences for farmers as well. Examples are the requirements to maintain the population of all species of naturally occurring birds in the wild (Art 3(1)of BD); to maintain or restore natural habitats and species of wild fauna and flora of Community interest in favourable conservation status (Art 3(1) of HD); and to improve the ecological coherence of Natura 2000 by maintaining and developing landscape features, as well as managing stepping stone areas, inside and outside the protected zones (Art 3(3) and 10 of HD). As discussed in Chapter 2, implementation of these requirements may require changes in land management practices by farmers, for example the enhancement of field boundary habitats (for example hedges and ditches, uncropped strips) and of other unfarmed habitat features (for example trees and ponds). Many of these management practices can be incentivised under voluntary schemes within the CAP.

It is not only the protection of habitats and species with high conservation value where EU legislative measures play an important role. In semi-natural habitats, such as grass and wood pastures grazed by livestock, including species rich meadows, dehesas or maquis, legislative measures have been designed to help prevent the intensification of semi-natural habitats, as well as to reduce the negative impacts of fertilisers in particularly sensitive areas, one of the main pressures on these habitats (see Chapter 2). Relevant legal requirements are set out under the EIA Directive and, although not directly focussed on biodiversity, under the Nitrates Directive. In agriculturally improved habitats, for example cultivated croplands and temporary grasslands, the key pressures on biodiversity that can be addressed effectively by legislative measures are those concerning the protection of common species and the connectivity of habitats under intensive arable, permanent cropand grassland systems. Provisions for the management of semi-natural landscape features and the measures to maintain connectivity between patches of semi-natural vegetation and between Natura 2000 sites, as well as linking agricultural land to habitats such as forests and wetlands, as outlined in Box 3, are particularly pertinent in these habitats.

Box 3: Implementation of EU legislative provisions addressing management of landscape features and ecological coherence and their interaction with CAP measures

Landscape features outside protected sites are addressed by the measures outlined under **Article 10 of Habitats Directive** which aim to promote the **ecological coherence of landscape** and to create stepping stones between protected areas. If well implemented, these measures would allow links to be made between semi-natural landscape features, such as thick hedges, ditches, scrubs, trees etc within homogenised cultivated croplands and semi-natural agricultural habitats, forest and other unmanaged common land, for example wetland and flood plain habitats.

Within the CAP, **some cross compliance measures contribute** to creating such ecological coherence, for example the compulsory GAEC standard requiring the maintenance of landscape features, the voluntary GAEC standards on the retention of terraces and the establishment and retention of habitats, and the obligation on Member States to retain a proportion of permanent pasture at the national/regional level. In addition, some RDPs use **agri-environment payments** to encourage more demanding management of semi-natural landscape features, or the introduction of buffer strips, wildlife strips, skylark zones, field margins etc into cultivated croplands.

It is unfortunate that the **implementation of the Article 10 measures has not yet started** in the majority of Member States. The more detailed management requirements to promote connectivity in varying bio-physical, environmental, climatic and agronomic conditions across the EU have not yet been developed. Strategic approaches and tools, for example national, regional and local plans, land use strategies and mapping tools are hard to find (European Commission, 2009c). It is therefore unclear whether there is sufficient co-ordination at national, regional and local levels when the Article 10 measures are implemented through agricultural management and whether they are synergistic with measures implemented in other sectors (such as forestry) and in urban development of rural areas and as a result, whether they are sufficient for maintaining connectivity between patches of semi-natural habitats. The missing plans and tools can also compromise the use of the Pillar 2 funds, for example Natura2000 payments, as without these there may be little evidence on which to base a justification for the introduction of a 'stepping stone' measure, even if well designed.

Only moderate successes have been achieved in the implementation of the above mentioned Directives. For example good progress has been made with the designation of a network of Natura 2000 sites in relation to the Habitats Directive. The designation of Natura 2000 networks is now legally largely complete in Belgium, Denmark, Germany, Italy and the Netherlands[16], while progress has been made in several other Member States (Estonia, France, Luxembourg and Poland) (European Commission, 2010h; IEEP, 2010). This provides a good legal underpinning but the next step has not been completed in many Member States, ie land management plans that stipulate locally specific management requirements needed to bring sites into favourable conservation status, adapted to the ecological needs of the species and habitats in the individual protected sites are often missing. Indeed, less success has been experienced in the implementation of the Birds and Habitats Directives. Examples of where issues remain include the incomplete identification of sites for inclusion in the Natura 2000 network in a number of Member States and the weak protection of these sites and species in practice. In addition, there has been a lack of progress in developing Article 10 coherence measures under the Habitats Directive outside the Natura 2000 network involving semi-natural features in the wider countryside and linking farmland habitats to other habitats, such as areas of common land and forest (see Box 3). Another issue is poor

[16] The completion of network has been measured by a 'sufficiency' indicator developed by EEA, defined as the level of sufficiency of representation of different habitat types and species in the network proposed by Member States (European Commission, 2010h)

implementation of provisions for impact assessments in relation to infrastructure development on Natura 2000 sites (required under Art 6(3) and 6(4) of HD), relevant for example where the development of farm infrastructure is proposed to modernise agricultural holdings, to encourage renewable energy production, or for the development of tourism in rural areas etc (IEEP, 2010). Not the least, delays in developing management plans or other means to specify management for Natura 2000 sites are hampering the degree to which these requirements can be integrated into agricultural policy (Alliance Environnement, 2007a; European Court of Auditors, 2008; European Commission, 2009c). This then has a knock-on impact on the degree to which agri-environment options under the CAP are able to be tailored to meet the specific needs of these sites.

Almost 40 per cent of the EU territory has been designated as a Nitrate Vulnerable Zone (NVZ) under the Nitrates Directive. Overall, trends in water pollution have either stabilised or decreased in two thirds of monitoring points of the EU-15 and ninety per cent of the EU-12 through the implementation of the Directive (European Commission, 2010g) and this is assumed to have a positive impact on biodiversity. The requirements on farmers which have underpinned these trends include, for example, obligations in NVZs to produce nutrient balances, build adequate manure storage and limit use of livestock manure up to 170kg N/ha/year (or up to 250kg/ha/year in farms under derogations). This has discouraged farmers from intensifying grazing management and has limited knock-on impacts on biodiversity through diffuse water pollution. However, impacts are not positive in all Member States. In some cases, poor implementation of the Nitrates Directive, or where a low proportion of land is designated as an NVZ, can have detrimental effects on terrestrial ecology, in intensive grasslands in particular. In addition, in relation to small extensive livestock farms that are frequently associated with semi-natural grasslands, questions have been raised about the scale of the investment required and the lack of funds needed to invest in on-farm infrastructure (for example for manure storage) in order to comply with the legislation. These pressures on small livestock farms can drive the abandonment of agricultural management in rural areas, if the continuation of grazing becomes unviable (IEEP and Alterra, 2010). Funding under Pillar 2 of the CAP provides some means of addressing this problem, by providing funding for the installation of such infrastructure. However difficulties can arise as the relevant measures are not always targeted at these farms, this type of expenditure is not always eligible, or farmers may be unaware of the availability of the funding.

In relation to the EIA Directive, its provisions for requiring a screening procedure in certain projects, including the restructuring of agricultural land and conversion of uncultivated or semi-natural habitats to intensive agricultural management, if implemented well, should be able to provide a strong legal underpinning to complement land management options within Pillar 1 and Pillar 2 of the CAP, particularly the quantitative requirement for Member States to maintain a proportion of permanent pasture (see Section 3.4 for further discussion). However, in practice the impact of the EIA Directive on biodiversity is minimal (Figeczky *et al,* 2010; IEEP, 2010; Beaufoy *et al,* 2011). A recent evaluation of the EIA Directive by the Commission did not highlight these concerns however. Instead, it notes the establishment of comprehensive procedures for the implementation of the Directive in Member States and increasing public participation (European Commission, 2009d). Other stakeholders have different views, finding the frameworks and criteria introduced by

Member States for screening the need for impact assessment of the projects for the restructuring of agricultural land and conversion of semi-natural pastures generally weak and effectively exempting most such projects (COWI, 2009; IEEP, 2010; Beaufoy *et al,* 2011; BirdLife International, 2011c).

In general, the evidence demonstrates that there is a mixed record of implementation for many of the EU Directives that impact upon biodiversity associated with agricultural management. This has implications for the degree to which other policy measures, for example those under the CAP can operate effectively (see Sections 3.3 and 3.4). For example, the success of agri-environment schemes depends critically on the effective implementation of wider environmental strategies and environmental legislation in the EU. If the basic requirements stipulated in legislation are not implemented fully, for whatever reason, then this can compromise the success of more demanding management through CAP voluntary measures.

3.3 Effectiveness of CAP Pillar 2 measures for delivery of biodiversity

As explained above, not all measures that have a potential to deliver biodiversity benefits are focussed directly on achieving biodiversity objectives, as demonstrated by their intervention logics. The main Pillar 2 measure that has a direct focus on biodiversity is the agri-environment measure and this, therefore, forms the main focus of this section. Other Pillar 2 measures with a partial focus on biodiversity or no focus on biodiversity but having a potentially positive impact are also considered, although in less depth.

3.3.1 The agri-environment measure

As noted previously, the agri-environment measure is the most significant policy measure used for maintaining, enhancing and restoring biodiversity on agricultural land (see Box 4). The flexibility of agri-environment measure allows Member States to introduce schemes to reflect different bio-physical, climatic, environmental and agronomic conditions and therefore to tailor management options to suit the particular combination of local biodiversity needs which vary enormously even within one region (OECD, 1993; OECD, 2010). In addition, the fact that the measure is mandatory across the EU combined with the requirement for a minimum proportion of the budget to be allocated to environmental measures more generally, has ensured the investment of certain proportion of EAFRD budget to this type of management. This is critical for preserving and enhancing biodiversity and habitats in their specific situations across Europe.

Box 4: Budget allocation and uptake of the agri-environment measure in the 2007-2013 period

For Europe as a whole, the total planned expenditure for the agri-environment measure over the 2007–13 programming period amounts to €37 billion (including national co-financing), 23 per cent of the total Pillar 2 budget. In terms of uptake, it is estimated that nearly seven million agri-environment agreements will be made over the 2007-2013 period, bringing approximately 42 million hectares (24 per cent of total utilised agricultural area) under some form of environmental management. By May 2011, 21 per cent of total planned agreements were in place and 41 per cent of the estimated area of land had been brought under beneficial management, accounting for 45 per cent of the planned expenditure on the measure.
Source: adapted from ENRD, 2011, on the basis of the European Commission data, May 2011.

Due to the degree of subsidiarity given to Member States in implementing the agri-environment measure and the varied biodiversity priorities in different regions, the ways in which the measure is implemented across the EU are very varied. A considerable body of evidence is available confirming that without the measure, the biodiversity status of agricultural habitats would be worse than it currently is, and that agri-environment has been critical in pursuing biodiversity targets on farmland and associated wooded areas (Cole *et al,* 2005; Verhulst *et al,* 2007; Smith *et al,* 2009). However, the last pan-European appraisal of effectiveness of the agri-environment measure, looking at the range of schemes implemented, was carried out in 2005 (Oréade Brèche, 2005). Given that many changes to agri-environment schemes have been made since this date, any more recent analysis of their effectiveness relies on evidence available from the mid-term review of the 2007-13 RDPs, other national evaluations, scientific studies as well as examples from the case studies. Concrete examples of agri-environment schemes that have proved successful for provision of different aspects of biodiversity on the ground are presented in Box 5. The impacts on birds are the most documented, although more recently evidence of impacts on other taxa is starting to emerge.

Box 5: Examples of beneficial impacts of agri-environment management

Impacts on birds

In **England** agri-environment actions including hedge management, ditch management, the creation and management of grass field margins and the sowing of seed-bearing plants were all found to have positive impacts on one or more of the following species: Goldfinch (*Carduelis carduelis*), Grey Partridge (*Perdix perdix)*, Yellowhammer (*Emberiza citronella*), Reed Bunting (*Emberiza schoeniclus*), Yellow Wagtail (*Motacilla flava*), Jackdaw (*Coloeus monedula*), Rook (*Corvus frugilegus*), Skylark (*Alauda arvensis*) and Whitethroat (*Sylvia communis*) (Davey *et al,* 2010). Management options targeted towards specific species have also had notable results, for example *in-field nesting plots* for Stone-curlew (*Burhinus oedicnemus*) and Skylarks on arable farmland have been effective in increasing their populations. Stone-curlew pairs increased from 71 to 103 breeding pairs between 2000 and 2005 and after more targeting and extension of management to a larger scale, breeding pairs in the UK increased to 300 (Evans and Green, 2007). With the introduction of specific management for Skylarks through encouraging uncultivated plots to be left in autumn-sown cereals, chick production increased by around 50 per cent compared to control plots in 2002 – 2003. Cirl buntings (*Emberiza cirlus*) have also greatly benefited from targeted management with population increases of 146 per cent from 1991 – 2003 and a further 24 per cent increase to 2005 following introduction of successive agri-environment programmes in Devon.

In **Scotland** the introduction of a simple management action that increased food for Corn Buntings (*Miliaria calandra*) in arable croplands helped to reverse the decline of this species. In grasslands, however, the same management was not sufficient to have the same effect, but after an additional action that delayed mowing was adopted, populations increased (Perkins *et al,* 2011). In **France**, agri-environment management in Natura

2000 sites with steeply declining populations of Little Bustard (*Tetrax tetrax*) required conversion of cereal croplands to grassland or fodder crops and restricted mowing regime, which contributed to reversing the trend, with an increase from 6 to 30 males between 2003 and 2009.

Portugal, the Castro Verde Zonal agri-envionment programme has been used to maintain and restore 64,000ha of HNV cereal steppe through traditional management and as a result the population of Great Bustard (*Otis tarda*) in the area has doubled (RSPB and BirdLife International, 2011).

Impacts on invertebrates
In **Hungary**, agri-environment management involving set asides sown with locally adapted seed mixture on former arable land, intended to enhance the habitat for the Great Bustard, had significant positive effects on grasshoppers (*Orthoptera*), bees (*Apidae*) and butterflies (*Rhopalocera*) (Kovács-Hostyánszki *et al* (2011d). In **England**, field margins sown with either a wildflower or pollen and nectar flower mix were found to increase species richness and abundance of bumblebees. Abundance figures ranged from 86 to 43 (± 14) per 100m for pollen and nectar margins and wildflower margins respectively and between 6 (± 2) and 8 (± 4) for mature and recently sown grass margins. Bees were virtually absent from the cereal crop itself (0.2 ± 0.1) (Pywell *et al,* 2005). Another study found that field margins sown with a legume-based pollen and nectar mixture attracted the highest total number and species richness of foraging bees and on average up to 269 times more bees than in parcels sown with other mixes and treatments (Cavell *et al,* 2007). Other arthropods such as the Marsh Fritillary butterfly (*Euphydryas aurinia*) have benefited from special management for cattle grazing on damp chalk grassland in England and their populations returned to areas from which they had entirely disappeared (RSPB and BirdLife International, 2011). In **Hungary**, agri-environment management involving sown set asides on former arable land, intended to enhance the habitat for the Great Bustard, had significant positive effects on grasshoppers (*Orthoptera*), bees (*Apidae*) and butterflies (*Rhopalocera*) (Kovács-Hostyánszki *et al,* 2011).

Impacts on mammals
Agri-environment management aimed at benefitting the common hamster (*Cricetus cricetus*) in the **Netherlands** have provided populations that have been re-introduced with the habitat and food sources they needed and so saved the species from the brink of disappearance. Delayed mowing, restricted harvesting and the provision of food and cover in summer until hibernation have allowed the hamster's natural second litters to survive and populations to grow rapidly between 2002 and 2009, with increases continuing (RSPB and BirdLife International, 2011; La Haye *et al,* 2010).

Impacts on plants
England, agri-environment management in both cultivated croplands and semi-natural grassland has been shown to deliver more varied species composition than existed in conventionally managed plots. Species diversity, including of rare arable weeds, was highest on un-cropped cultivated margins, followed by spring fallow margins and cropped conservation headlands without fertiliser inputs. On cropped margins, diversity was generally lower due to competition from the crop. Fertilised cropped conservation headlands were the least diverse option and were similar to cereal crop controls (Walker *et al,* 2007).

A good survey of the impacts of the use of the agri-environment measure on biodiversity in different parts of Europe is provided in a recent review of 59 seminal agri-environment studies on 10 taxa by Le Roux *et al,* 2008 (see Box 6). The researchers identified 59 studies undertaken in the EU Member States and Switzerland that complied with stringent criteria for the monitoring of agri-environment plots paired with control plots and for evaluating the results. Over half of the studies (31) were successful in demonstrating a positive change in the monitored species populations through agri-environment management. Less than a half of studies (28) were unable to demonstrate a positive change and reported variable impacts, although further investigations were not always carried out with regard to the factors that played role in this outcome. These include factors such as the time-lag between the management being implemented and the results becoming evident, non-linear dependence of species on the management in question, other agricultural and non-agricultural factors (as discussed further in Chapter 4). However, the authors underline two important factors that are likely to have led to the variable impacts of some of the agri-environment schemes reviewed. Firstly, sometimes the specific management requirements appeared not to be targeted to the conservation objectives sought. Secondly, knowledge gaps and issues relating to the implementation of schemes and specific management prescriptions were likely to play role. For example gaps in scientific knowledge about biological processes, particularly establishing causalities in biological, economic or social dynamics affected a number of schemes that were studied. Also the area covered by the scheme was not always sufficient to produce a more pronounced change in ecology. This implies that, although the results of agri-environment monitoring may show variable impacts on biodiversity, this does not necessarily indicate poor agri-environment design or management as many factors may influence the results. Nonetheless such findings are important to note when they occur and efforts need to be made to discover the reasons for the different impacts experienced in order to help modify or revise scheme design or implementation if needed.

Box 6: Effectiveness of the agri-environment measure across the EU on 10

A recent meta analysis of 59 different studies carried out between 2003 and 2008 relating to agri-environment schemes operating in EU Member States and Switzerland and their impact on biodiversity (Le Roux *et al,* 2008) shows a range of impacts on different taxa.

Number of studies showing impact of agri-environment on species richness of 10 taxa

Taxon	Number of studies	Positive change[1]	Adverse change[2]	No change or variable impact[3]
Plants	14	8	0	6
Snails	1	1	0	0
Grasshoppers	6	3	0	3
Ground beetles	2	1	0	1
Butterflies	4	2	0	2
Spiders	6	1	0	5
Hoverflies	1	1	0	0
Bees	8	5	0	3
Small mammals	1	1	0	0
Birds	16	7	0	9

1. Positive change in species richness of the monitored populations after implementing AES.
2. Adverse change in species richness of the monitored populations after implementing AES.
3. No change or variable monitoring results, with beneficial impact showed for certain species/in certain plots and adverse changes recorded on other species/in other monitored plots after implementing AES.

Number of studies showing impact of the agri-environment on arable land, grassland, or mixed systems

	Grasslands		**Arable land**		**Mixed**	
	Positive change	Variable impacts[3]	Positive change	Variable impacts[3]	Positive change	Variable impacts[3]
Plants	3	4	4	0	1	2
Birds	3	4	3	4	1	1
Arthropods	7	4	4	6	3	3
Others	1	0	0	0	1	0

Determining the effectiveness of agri-environment schemes requires clear objectives and targets to have been established prior to implementation. The case studies have demonstrated that the degree to which biodiversity objectives are clearly identified within agri-environment schemes varies in practice. Some Member States use quantified biodiversity targets to underpin their schemes and others use more qualitative approaches, sometimes for justified reasons, as set out in Box 7. However, the European Court of Auditors recently stressed that the lack of targeting and monitoring of environmental effects, along with insufficient clarification, collection of information justification and reporting on outcomes of individual agri-environment schemes, are the main shortcomings of the agri-environment policy that has to be improved in the future (European Court of Auditors, 2011a).

Box 7: Case study experiences in integrating quantitative biodiversity targets in agri-environment programmes

In **England (UK) and Baden-Württemberg (Germany)**, agri-environment is used as tool to contribute towards the national or regional targets for Biodiversity Action Plan habitats and species, national protected areas and Natura 2000. The targets have been quantified with a considerable amount of precision and integrated into the design of agri-environment programmes. In England, this approach has made a significant positive contribution to the implementation of the UK Biodiversity Action Plan, despite the fact that there continues to be a lack of improvement or continuing slow decline in certain key species/habitats.

France has published only recently a revised *National Biodiversity Strategy 2011-2020* including 20 biodiversity targets that are to be integrated in all sectoral policies. Agricultural habitats are included in target 12 which focuses on the sustainable use of biological resources in fisheries, agriculture and forestry. However, none of these targets have been quantified.

In the **Czech Republic** and **Romania** the quantification of targets was deemed less practical than setting conservation objectives by expert judgement. Therefore the management options that are promoted aim to maintain or encourage beneficial land use patterns. This aims to avoid risking the trial-error phase of setting up quantified targets with uncertain effects on the results of the changes in management on the ground and cost involved in the quantification exercise. It is too early to judge the success of such schemes designed without quantified targets as they have been in place only since 2004 and 2007, but a good deal of consensus between agricultural and environmental authorities and stakeholders on their positive impact on biodiversity, as well as good levels of uptake by farmers are proof of good progress in both countries. Monitoring results gained so far in the Czech Republic demonstrate a moderately positive effect of the agri-environment schemes on species richness of birds, with some issues arising for species richness of insects in grasslands.

To date, **Greece** has also not made efforts to set biodiversity targets for farmland.

Clarity on biodiversity targets is only part of the solution for improving effectiveness of schemes. Agri-environment schemes are often designed to deliver multifunctional management that is focussed on a range of environmental needs in the countryside (Bathgate *et al,* 2008; Bryan and Crossman, 2008; Finn *et al,* 2009; Lehmann *et al,* 2009; Rounsevell *et al,* 2010). In considering the management that is most appropriate for generating biodiversity outcomes in the agricultural habitat in question, it should be acknowledged that overall environmental benefits from a particular ecosystem often depend on finding ways of addressing multiple, rather than single environmental issues. In addition, management focussing solely on biodiversity as an objective has the potential to affect delivery of other environmental objectives (such as water quality or soil conservation), most often in a positive way, but negative impacts can occur, so both synergies and trade-offs in the ecosystem can take place. A systematic examination of all these synergies and trade-offs is needed to deliver sustainable outcomes for all ecosystem services in an efficient way (Hart *et al,* 2011a).

Pragmatic thinking about the relative priorities of the multiple objectives and careful weighting of environmental performance of the scheme can provide some answers. For example buffer strips have been promoted for delivery of multiple objectives including biodiversity in some site-specific studies, although their impact at a variety of spatial scales has yet to be examined. Evidently, buffer strips can benefit terrestrial species, including plants, invertebrates, small mammals and some birds. However, these benefits can be constrained by the historical impacts of farming (for example high soil nutrient levels and habitat fragmentation) and are greatly affected by their location and the precise way in which they are established and managed. Aquatic environments can benefit from riparian strips that are able to reduce pollution from pesticide and fertiliser drift and nutrient-rich run-off. However, a buffer strip designed for reduction of run-off from the adjacent fields may need to be planted, located or managed differently to retain its function as a sediment sink (Hart *et al,* 2011a). So, it is not entirely straightforward that multi-objective schemes for delivery of benefits for biodiversity and benefits for soil and water through the same management are most cost-effective and generally worth promoting. Rather, the need for weighting of different priorities should be consistently highlighted in policy design.

The range of objectives that agri-environment schemes are designed to address, as well as complexity of pursuing biodiversity management as a goal, are some of the reasons for why there is much less evidence on their effectiveness in delivering biodiversity on the ground than on their potential to sustain biodiversity. Other reasons are the limited availability of comparative and quantified information at EU scale arising from monitoring and a lack of data about the baseline conditions and the counterfactual (Kleijn *et al,* 2006; Kleijn and Sutherland, 2007). The use of the Common Monitoring and Evaluation Framework result indicator relating to the 'area under successful management' is used frequently within evaluations, which provides no evidence or detail on the specific benefits of individual schemes on the ground (European Court of Auditors, 2011a). It should also be noted that the available scientific evidence is not comprehensive and is not available for all Member States. Indeed, evidence relies mainly on monitoring studies in seven Member States, although evidence from the new Member States is beginning to emerge (Tryjanowski *et al,* 2011).

Agri-environment schemes in semi-natural agricultural habitats

The impact of agri-environment management on semi-natural grassland habitats is well documented. Much research has been carried out on the impacts of schemes on semi-natural landscape features, specific taxa including birds, insects, such as butterflies, bumblebees, moths, grasshoppers etc and success demonstrated for some taxa (birds) more consistently than for others (invertebrates). Particular successes of agri-environment management in achieving conservation objectives for maintaining semi-natural habitats have been achieved where schemes have been based on a scientific understanding of the ecological needs of different habitats and species, tailored to local conditions and targeted spatially, and where they have involved flexibility to adapt and improve management options.

The main agri-environment management options which have been shown to be effective in relation to delivering biodiversity objectives include hedgerow management (Chamberlain and Wilson, 2000; Merckx *et al,* 2009), modifying cutting regimes (Michel *et al,* 2007), ensuring appropriate grazing regimes (Batáry *et al,* 2007a; Batáry *et al,* 2007b; Karmiris and Nastis, 2007; Marriott *et al,* 2009) and the maintenance of permanent pasture (McAdam *et al,* 2005; Verhulst *et al,* 2007).

The beneficial impacts of agri-environment schemes for maintaining semi-natural grasslands and encouraging the continuation of HNV farming practices, such as hay-making, extensive sheep, goat and horse shepherding and traditional agro-forestry, have been noted by a number of experts. Examples of these schemes are presented in

Box 8. Although it is too early to judge effectiveness of these schemes in a manner rigorously relying on metrics and data on population trends, the beneficial effects of the HNV practices have been amply demonstrated. The suitability of the HNV practices is evident particularly with regard to maintaining landscape heterogeneity, thereby creating conditions for survival of plants and species characteristic of semi-natural habitats at landscape scale (Beaufoy *et al,* 1994; Cooper *et al,* 2007; Paracchini *et al,* 2007; Beaufoy and Marsden, 2010).

Some of the agri-environment schemes that target HNV farming systems combine land based management with other agri-environment options to support local breeds and plant genetic resources (article 39(5) of Council Regulation 1698/2005). Several examples of successful agricultural management in HNV areas are set out in

Box 8. As discussed in Chapter 2, the local genetic resource has become threatened in many areas by the prevailing trend to use more productive breeds, plant and tree varieties many of which are not necessarily well adapted to the needs of semi-natural habitats. The integration of objectives for traditional breeds within the requirements of the HNV agri-environment management therefore brings benefits both for genetic diversity and agriculture itself and for the maintenance and enhancement of the associated semi-natural habitats.

Maintaining semi-natural habitats through broad agri-environment schemes targeting HNV farming systems is beneficial not only for biodiversity. Alongside the other environmental benefits to soil, water and ecosystem services they provide, they can also play an important role for the local economy, if accompanied by relevant measures (for example for employment, diversification, market access etc), and in doing so enable ongoing provision of biodiversity benefits by preventing abandonment of these habitats. This is explored further in Chapter 5. The interplay between biodiversity friendly management and economic viability is not straightforward and compromises sometimes need to be found. For example, although allowing a certain amount of cropping on 'dehesas', is less desirable from a strictly ecological perspective, it enables farmers in less productive and drier regions to cope with problems in feeding livestock in summer, thereby improving the economic viability of 'dehesas' and enabling the continuation of biodiversity management there (Carricondo, pers comm).

Box 8: Maintaining beneficial HNV practices in semi-natural habitats through agri-environment schemes

Spain – *HNV schemes for maintenance of 'dehesas'*. The schemes implemented in Extremadura, Castilla-La Mancha and Andalucía (and Castilla-y-Leon under 'forest environment') include management requirements for no or limited cereal/leguminous/ fodder cropping (common in more intensively managed parts of 'dehesas'), stocking densities of between 0.1 and 1.0 LU/ha and other restrictions to avoid overgrazing, to ensure the maintenance of landscape features (for example stonewalls), to maintain or increase tree density (*Quercus*, *Olea*), requirements for their pruning and regeneration as well as shrub management and some voluntary commitments such as grazing exclusion areas or organic cropping. The scheme can be combined with another agri-environment scheme for the protection of local breeds – pig, cattle, sheep and others -- which traditionally support the Dehesa habitats and organic rearing of livestock.

United Kingdom (England) – *HNV grassland management for the Marsh Fritillary butterfly* *(Euphydras aurinia).* Populations of the Marsh Fritillary butterfly that had become almost extinct in large parts of Europe due to the loss of damp and chalk grasslands, have stabilised or are increasing as a result of implementing the AE scheme**.** It involves management options suited to the needs of the fritillary, crucially involving an uneven patchwork of short and long vegetation on damp, particularly short grassland. Extensive grazing by cattle or traditional horse breeds (densities no more than 0.2 – 0.3 LU/ha); restrictions on burning of vegetation; and prescriptions for mowing and scrub removal and management are the focus of the management required under the agri-environment scheme.

United Kingdom (Scotland) – *HNV grassland management for Corncrakes* (*Crex crex*) resulted in trebling their numbers since the 1990s. Current schemes focus on mown grassland, grazed grassland and re-created grassland. Actions include the removal of livestock at certain times of the year with restrictions of livestock density from 0.3 up to 1.4LU/ha, restrictions on mowing and cutting dates, establishment of tall vegetation on wet ground, sometimes establishment of strips at the field edge of over 5m in width.

Bulgaria – The ***HNV scheme for restoration and maintenance of overgrazed grasslands*** is a broad-brush scheme involving requirements for mowing and grazing management, for example minimum and maximum stocking density, manual mowing, no new drainage and ploughing is not permitted.

Romania – *HNV meadows management*. The scheme includes requirements for the use of traditional manure, no use of chemical fertilisers, collections of mass cuttings within 2 weeks after mowing, restrictions on grazing in flooded pastures, etc; an additional payment is available for the **'***maintenance of traditional practices'* (involving a prescription to use manual mowing only). Another HNV scheme for protected bird species, Corncrake (*Crex crex),* Red-footed Falcon (*Falco Vespertinus*) and Lesser-grey Shrike (*Lanius minor*), targets land management in specific Natura 2000 sites.

Slovakia – *HNV schemes for the protection of semi-natural pastures* involve management specifically tailored to different types of grasslands with differentiated payments. Management prescriptions are included for mowing; shepherding without the use of fences is compulsory, no drainage is allowed and no mulching is permitted for the heathland and xerophytic grassland or mesophile grassland. In addition there is a ban on grazing in lowland alluvial meadows, on hydrophilous higher ground vegetation, marshy meadows and *Molinia* and mountain hay meadows.

Sweden – *HNV pasture management* includes management options for pastures with specific values, such as limestone pasture, mountain pasture, hay meadows and wetlands, applicable to several types of Natura 2000 habitats. Other schemes have been designed for wooded pastures. The objective of the scheme is to encourage continuation of low-input management appropriate for these habitats, with requirements involving grazing and harvest management, ban on use of pesticides and limit on rotational ploughing.

Source: own screening of RDPs 2007-2013; RDP mid-term evaluations; RSPB and BirdLife International (2011); Carricondo, pers.comm.

In extensively managed semi-natural habitats, Pillar 1 direct payments are often needed alongside Pillar 2 agri-environment management payments if farming is to be maintained in these areas. Whereas the agri-environment payment will cover the additional costs and income foregone associated with the specific agricultural management carried out for biodiversity, direct payments can help ensure the basic viability of farms with these habitats in remote, often economically lagging areas. The Romanian case study demonstrates that avoiding abandonment in these areas in Romania is particularly important, because these farms still retain the traditional farming knowledge and skills handed down over generations and that are adapted to the local ecosystems. In these situations the cessation of farming would risk an irretrievable loss of such farming skills. However, some valuable agri-environment schemes, for example the schemes designed for wooded semi-natural habitats in Estonia and Sweden, with an important element targeting Natura2000 sites, have been put in place largely as a reaction to the ineligibility of such habitats for direct payments under Pillar 1, due to eligibility issues surrounding trees, shrubs and scrub which are characteristic of the conservation value of these pastures (see the section below). Given that the agri-environment budget is already overstretched, and has multiple objectives to deliver on, it would be more prudent perhaps to resolve the eligibility issues and enable farmers in these areas to receive direct payments rather than to have to introduce additional measures under Pillar 2.

Besides encouraging the on-going maintenance of biodiverse habitats, the agri-environment measure also has a significant role to play in their restoration or recreation. Restoration schemes have been used to restore a range of semi-natural and natural habitats that have been degraded by previous agricultural land use. Examples include the restoration of raised bogs, heather moorland and different grassland systems (acid, calcareous, mesotrophic), wetlands and their associated landscape features in several Member States including England, some German Länder, Finland, Denmark and the Netherlands. In designing the restoration schemes, it is critical to determine the restoration potential of the habitat and the kind of management required, and to identify the activities that need to stop for the habitat or feature to be restored. This assessment needs to be site-specific and typically needs to take account of factors such as soil type, nutrient status and wetness, management history, location of the parcel in relation to existing semi-natural features etc. For the restoration of natural habitats in particular, for example for blanket bogs which cover whole landscapes in Northern Europe, the site-specific restoration analysis is needed to design actions for reversing the habitat decline that was triggered in the past by inappropriate afforestation, burning, drainage and heavy grazing (BRIG, 2008). Given the variations in site-specific analyses, agri-environment restoration actions differ significantly between habitats and depending on where they are sited geographically (see Box 9). Some restoration actions, particularly in degraded wetland areas and traditional wetland biotopes, can also be addressed by using the Pillar 2 capital investment measures, such as the 'non-productive investments' or 'preservation of rural heritage' measures rather than the agri-environment measure.

Box 9: Examples of successful restoration actions in semi-natural and natural habitats in the UK

Agri-Environment scheme for upland heathland restoration. A series of restoration schemes in Exmoor National Park (England), which was subject to overgrazing prior to 1993, helped to increase average heather cover from 5 to 29 per cent, increased the height of dwarf shrub from 5 to 23cm, increased the number of vegetation types and in particular increased breeding populations of Skylark (*Alauda arvensis*), Linnet *(Carduelis cannabina*) and Stonechat (*Saxicola rubicola*). These outcomes are due to a reduction of grazing pressure to 0.10 LU/ha (initially 0.33LU/ha in summer), prescriptions for the use of summer-sheep only and no grazing in winter (initially 0.68LU/ha) (Natural England, 2009).

Agri-Environment scheme for wetland restoration. A restoration scheme designed to adapt land management on arable land surrounding the protected wetland area in Berrington Pool, England, resulted in 90 per cent of the water catchment having no-inputs on their grassland, whereas ten years ago the entire catchment was under arable production with soil run-off and regular fertiliser application causing eutrophication and damage to the site. The change in the management of the wetlands should lead to major improvements in water quality and the aquatic environment of the area (Natural England, 2009).

Agri-Environment schemes for the restoration of natural blanket bogs. A restoration scheme in the Pennines, **England**, supported tenant farmers in the blocking of 25km of moorland drainage ditches ('grips'), to reverse the drying out of blanket bog habitat, as well as paying farmers to adopt sensitive grazing management regimes. In another scheme in the Southern Pennines, the agri-environment scheme funded the blocking of drainage channels and a reduction in grazing stock numbers, as well as financing a carefully managed regime of heather burning. As a result, the whole protected area has returned to a favourable condition. Projects such as these mean that 96 per cent of heather moorland habitats in England, including natural blanket bogs as well as varied semi-natural bogs, are now in a favourable or recovering state, compared to just 25 per cent six years ago. In **Northern Ireland**, a restoration scheme in the second largest remaining expanse of intact blanket bog (Cuilcagh Mountain), reduced stocking rates to 2 ewes/ha with no grazing permitted during winter. Farmers are also paid to undertake the blocking of drainage channels on their land. As a result, characteristic vegetation including heather, moss and dwarf shrubs have recovered to a favourable condition, after significant degradation due to overgrazing and uncontrolled burning in the past. This indicates the potential of restoration for reversing the decline natural blanket bogs in Northern Ireland, 90 per cent of which have been significantly damaged or destroyed. Similar recovery has been achieved in Forsinard Nature Reserve in Caithness, **Scotland** through a programme of tree removal, drainage blocking and deer management. Water levels are recovering, cotton grass has expanded and several species of conservation concern such as skylark have returned to the area (Natural England, 2011; RSPB Scotland, 2011; The Moorland Association, 2011; UK NEA, 2011).

In relation to more demanding management that targets specific needs of species and habitats, less success has been experienced across the EU in ensuring that the scope and quality of management prescriptions, their potential to deliver and payment levels are always at sufficient levels. Demanding schemes are vital but need more resources (both people and financial) and to achieve good results schemes often need to be adjusted over time to ensure that optimum combinations of management are available to deliver the desired results (RSPB and BirdLife International, 2011). Chapter 4 explores the range of factors that influence uptake to ensure that the biodiversity benefits of these schemes are met, such as putting in place sufficient communication, policy promotion, capacity building and supporting collaborative management at the landscape scale.

Additionality of agri-environment schemes is an important factor in the effective use of the public money. A report by the European Court of Auditors underlined the importance of examining the added value of schemes that aim to maintain environmentally friendly farming practices only (European Court of Auditors, 2011a). However, scientific evidence demonstrates that schemes aimed at maintaining low-intensity management in semi-natural habitats, as illustrated in

Box 8, are very important for the continuation of management, such as grazing on which otherwise abandoned or intensified semi-natural grasslands depend (Báldi, A; Oñate J.; pers. communication).Annex 2-1 (p227) demonstrates that these practices significantly benefit landscape complexity and have other profound benefits to biodiversity.

Agri-environment schemes in cropped areas (including arable and temporary grass)

In croplands agri-environment schemes tend to provide two levels of biodiversity management, which have two distinct and important roles. The first involves the use of basic generic options, to encourage a large proportion of farmers to undertake a basic level of beneficial biodiversity management, for example to maintain unfarmed features such as hedges, field margins, trees, ponds, banks, terraces, ditches, as well as in-field fallow areas and stubbles over winter. These options build on the GAEC standards in cross-compliance and, therefore, what is available under agri-environment schemes will vary in different regions, depending on what is stipulated within the GAEC standards. The main effect of basic and generic options under agri-environment schemes tends to benefit populations of widespread and common farmland species. . Secondly, agri-environment schemes can provide management options with a higher degree of thematic and geographical targeting and tailoring that aim to enhance locally specific habitats and species. Some of these schemes have proved to be highly beneficial in bringing back locally extinct specialist species or stopping their decline. Such schemes have been shown to benefit birds, insects, small mammals and plant genetic resources. However, successes have been achieved more for some species (for example birds) and vary according to location and geographic scale (Randall *et al,* undated). In some cases mixed effectiveness at the regional scale may be due to the fact that the mix of management prescriptions do not quite address the ecological requirements of species or habitats (Llusia and Oñate, 2005; Díaz *et al,* forthcoming). In other cases it may be due to the delayed response of species to the introduction of schemes, or due to non-linear effects of schemes on species population sizes or species composition (Tscharntke *et al,* 2005; Filippi-Cadaccioni *et al,* 2010). As discussed in Chapter 2, the impacts of actions in restricted areas often are constrained by habitat fragmentation, which reduces their effectiveness because of the need for management to be carried out at a landscape scale (see Chapter 2; Batáry *et al,* 2011; Merxcks *et al,* 2010; Concepción *et al,* 2008).

Evaluations of the uptake of agri-environment management in agriculturally improved habitats show that largest proportions of agri-environment budgets are used to support environmental management within arable, intensive grassland as well as integrated arable and permanent crop systems, depending on the importance of these sectors in individual countries (Katona-Kovács, 2007; the French case study). However, this does not necessarily generate higher levels of biodiversity as an outcome, rather it simply reflects the fact that payment rates are bound to be higher in productive areas since payment rates are based on income foregone calculations.

The benefits associated with agri-environment schemes in intensive croplands are found mainly in instances where a combination of management options provide key ecological resources for vulnerable species, in particular breeding habitat and year-round food resources, as these tend to be reduced by agricultural intensification and specialisation. The main priority for most of the declining species associated with such habitats (especially birds but also butterflies and pollinating insects), are options that provide in-field resources (such as fallow patches or fields, over-wintered stubbles, crop diversity and crops with reduced pesticides (Aakula, 2011; Alanen *et al,* 2011; Butler *et al,* 2007a). However, some species also benefit from field edge management measures, such as the planting of field margins with seed-rich or nectar-rich plants, or reductions in the use of pesticides in field headlands. Maintaining populations of common species has often proved to be more of a challenge due to the scale of response that is needed, but there have been some successes and recent initiatives are encouraging. Good evidence exists also to show that locally adapted improvements in crop rotation can bring about benefits for biodiversity (BIO Intelligence, 2010; Vepsalainen, 2007; Bretagnolle and Houte, 2005).

However, in-field options tend to be less attractive to farmers than field edge management that impinges less on core farming operations. As a result, less success has been achieved for biodiversity management within improved habitats, particularly within high yielding arable systems, due to continued low levels of uptake of in-field fallow options. This is apparent both in the agri-environment schemes in England (UK) and in Baden-Württemberg, which have demonstrated very low uptake of these options for those in-field locations where they are most needed for biodiversity. Nonetheless, the case studies underline that there have been some notable successes of agri-evironment schemes in improving species richness and abundance and the quality of improved habitats and some of those are set out in Box 5.

Box 10: Examples of benefits of agri-environment management in intensive arable croplands and temporary grasslands in case study areas

In **Baden Württemberg**, conservation management through voluntary contracts is well-accepted by farmers and makes an important contribution to environmentally-friendly agriculture because without the agri-environment measure, land managers would have adhered to legal obligations only. However, not all management options are equally successful in terms of uptake and particular problems are experienced with the uptake of demanding schemes in arable areas.

In **France**, the scheme targeting the Little Bustard (*Tetrax tetrax*) in the Natura2000 sites, based on the introduction of in-field plots of grass, field boundaries and headlands, and involving a restriction of mowing, is considered by experts as a success which contributed to reversing the decline of the species (Bretagnolle *et al,* 2011).

The **Czech Republic** has experienced an unexpectedly high uptake of in-field wildlife strips (‘bio-belts’), with 2,000 ha of land under this scheme , representing approximately 2,000 km of feeding strips for species. A separate scheme focussed on in-field fodder has been undertaken by farmers much less frequently, although the monitoring scheme has shown that this has had a more significant beneficial outcome for biodiversity (DHV, 2010, quoted in Czech case study).

Some of the less successful aspects of the implementation of the agri-environment measure in cultivated cropland and temporary grassland is the focus on individual holdings, which limits the spatial scale and the potential benefits of the schemes (European Court of

Auditors, 2011a). Evidence shows that the scale at which beneficial management is carried out is a critical factor influencing the achievement of biodiversity outcomes because of habitat fragmentation and the widespread loss of species in landscapes that are dominated by intensive agriculture (for example Merckx, 2009; Zeebroek and Gijseghem, 2011). To be effective schemes often need to cover an adequate proportion of the farmed landscape (the size of which will be objective and context-specific) or be focussed to specific areas of high importance to gain concentrated impacts, or targeted to locations where particular species are know to occur.

Beyond the improved cereal croplands and temporary grasslands, it is worth noting the benefits of agri-environment management within rice and tobacco systems. Biodiversity benefits are likely to be delivered indirectly by agri-environment schemes whose primary purpose is to encourage sustainable rice production more generally (for example in Valencia[17] and Catalonia in Spain, and in several Italian regions). These schemes tend to be targeted at wetland areas used for rice production inside or adjacent to protected areas (Natura 2000 sites and Ramsar sites) and involve management options for input control, mechanical weed control and water table management, all of which should help to reduce external pressures on biodiversity. Likewise, the schemes aimed at environmental management in tobacco systems (for example in Andalusia and Umbria) involve management options such as green cover, stubble management, mechanical weed control, no tillage, irrigation management and reduction in plant protection products used which help to mitigate the negative impacts of conventional management. However, for an evaluation of actual impacts on the ground, monitoring results would have to be collected in a comprehensive fashion.

Extensive cereal cropped areas, particularly the dry steppic cereal systems in the Iberian peninsula, have a high biodiversity importance, and maintaining and enhancing their biodiversity value should be an important focus of agri-environment schemes in these areas. Good evidence of the success of such management is provided in literature, including the beneficial impacts of steppe bird schemes in extensive arable systems in Spain, Portugal and France (Moreno *et al,* 2010; Reino *et al,* 2010). In addition, positive outcomes for biodiversity have been achieved through management options for maintaining trees and hedgerows, the establishment of hedgerows and planting trees and bushes in mixed, extensive arable-fruit-olive systems in Southern Europe, as noted in the Greek case study, and through agri-environment management with traditional mixed farming practices in arable-sheep farming (Caballero and Fernández-Santos, 2009). Similar schemes can help addressing the challenges facing High Nature Value farming by addressing the needs of these mixed farming systems with mosaic-like patterns of grazing, hay meadows, arable crops, traditional orchards or traditional practices for fruit, nuts and olive trees (Concepción *et al,* 2008; Beaufoy and Marsden, 2010). Examples of schemes used to promote biodiversity in extensive cereal croplands and their results, where available, are set out in Box 11.

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[17] La Comunidad Valenciana.

Box 11: Examples of the use of the agri-environment measure for farmland birds and other objectives in extensive cereal croplands

Management for steppe birds. The environmental and socio-economic effectiveness of the agri-environment schemes for steppe birds in dryland crop systems in Natura 2000 sites in **Spain**, for example Great Bustard (*Otis tarda*), Little Bustard (*Tetrax tetrax*), Stone-curlew *Burhinus oedicnemus*), Montagu's Harrier (*Circus pygargus*), Red-legged Partridge (*Alectoris rufa*) etc) during the period 2007-2013 was evaluated by SEO/Birdlife in 2009. The management options used within these agi-environment schemes vary from region to region but the majority of schemes include a combination of options for crop rotation, cultivation of leguminous species, delay of sowing and/or harvest, closed period in spring and maintenance of field margins. The monitoring was set out on eight pairs of fields of similar size, crop type and landscape type in each of 17 study areas throughout Spain. One of the fields in each pair was farmed according to the regional agri-environment scheme and the other farmed conventionally. Difference in species richness and abundance among paired fields was used to estimate the effect of the scheme on birds. Pairwise comparisons showed an overall significant effect of schemes on the abundance and species richness of both territorial and foraging farmland birds. The overall effect was positive, with larger numbers of individuals and species in fields with agri-environment schemes than in control fields farmed conventionally. Nevertheless, this effect varied significantly among study areas and analysis is underway of the reasons for mixed effectiveness at regional scales to establish whether it is due to adequacy of management prescriptions to the habitat requirements of steppic birds, to non-linear effects of regional species pool sizes or species composition, or to landscape-scale effects not addressed by agri-environment schemes (SEO/Birdlife, 2011).

Management for birds in extensive cereal croplands. In **Bulgaria**, the HNV scheme for extensive arable management aims to protect birds in Natura 2000 sites. It involves a requirement for a wildlife-friendly fallow area on 10-20 per cent of the farmer's holding, but not less than 1 ha. In **Slovakia**, an arable scheme for the protection of the Great Bustard involves prescriptions for mowing and use of pesticides, rotations with winter cereals and oilseed rape, in which perennial forage grass and arable must constitute less than 70 per cent of the farm (own screening of RDPs 2007-2013).

Management with multiple objectives in extensive croplands. In **Estonia,** an arable HNV scheme for environmentally friendly management has been introduced, including management requirements in relation to buffer strips, landscape features and limit on pesticides) (own screening of RDPs 2007-2013).

Agri-environment schemes in permanent crop systems

The agri-environment measure plays an important role for the continuation of traditional management extensive permanent crops, such as olive groves in Mediterranean regions and traditional fruit and nuts orchards in Central and Southern Europe. As stated in Chapter 2, permanent crop habitats are essential for a range of species, especially where they are managed by low input, traditional farming systems. Agri-environment schemes to support these systems are illustrated in Box 12.

The types of management that are most frequently used to improve biodiversity associated with intensive permanent crops involve integrated production, focussed largely on olive, nuts, fruit and wine systems. In the Czech case study integrated management in vineyards and orchards has achieved significant benefits for biodiversity, with the number of butterfly species and abundance increasing in comparison with conventionally farmed parcels and having a smaller impact also on beetles (Biocont Laboratory, 2010, quoted in the Czech case study). The timing of pesticide applications in intensive tree systems through integrated management schemes was shown to be effective for biodiversity in the Mediterranean (Christopoulos, 2011). However, particularly in the context of the new Framework Directive for the Sustainable use of Pesticides, it may be that some of these management options (involving input control, green cover and record keeping) should be undertaken in future at the cost of the farmer as part of the environmental baseline. High levels of uptake for these schemes is also thought to be a good sign of farmers' growing awareness about the environmental benefits of integrated management (Katona-Kovács, 2010).

Box 12: Agri-environment management in traditional permanent crop habitats

Germany (Brandenburg and Berlin) - Maintenance of traditional orchards. Under the agri-environment scheme in Brandenburg and Berlin a package of management actions is available for the maintenance of traditional orchards. Actions include specifying the density of trees per hectare (min 30 trees, max 100 trees), the maintenance of grassland between and under the trees with restrictions on mowing rates (at least once per year); replacement of dead trees in old sites; and the prohibition of the use of pesticides and chemical-synthetic fertilisers.

Cyprus – Preservation of traditional orchards. Schemes implemented in Cyprus aimed at the preservation of traditional landscapes include requirements to record all cultivation practices; for trees such as almond, carob, hazelnut and medicinal/aromatic plants such as *Rosa damaskina*, etc weed control can only be carried out mechanically and the base of trees must be protected.

Spain (Catalonia) – Alternative cultivation of vines. Management actions available under the scheme includes the use of pheromone treatment to protect against the vine moth (*Lobesia botrana*); the use of a system of traps to control pests; a ban on the use fungicides three weeks before harvest; the prohibition of the use of pesticides on margins; and the need to keep a record of all actions undertaken on the holding. **Maintenance of nut production.** Actions implemented under the scheme include the mechanical removal of shoots; the maintenance of green cover over at least 50 per cent of the area and to ensure that this is subject to organic, manual or mechanical weed control; the need to keep a record of all actions undertaken and participate in training activities. Payments are higher in irrigated areas than in non-irrigated areas.

Hungary – Management of traditional stone fruit orchards. This horizontal scheme targets the preservation of traditional fruit growing methods and the vestiges of garden cultivation that survive in the country, as well as to sustain and preserve plantations (for example flood-plain orchards) that are significant from a landscape aspect, together with the related traditional species. Traditional (scattered) orchards are defined as a plantation which is composed by homogenous or mixed fruit trees with the density of minimum 30 tree/ha and maximum 80 tree/ha fruit tree.

Slovenia – Conservation of meadow orchards. In Slovenia, under the scheme to conserve natural resources, biodiversity, soil fertility and traditional cultural landscapes, a package of actions has been designed specifically for the conservation and protection of meadow orchards. Actions include the compulsory enrolment in an educational programme of not less than four hours per year; mandatory record keeping of all work carried out on the holding including the levels of animal manure and plant protection products; use of sewage sludge, mud and residue from the farms is not allowed and only compost produced on farms can be applied; the implementation of rich pasture on open surfaces and under tree cover; maintenance of trees and restoration (replanting) or plantations with minimum and maximum densities (min 50, max 200 trees/ha); restrictions on pruning dates for the established trees; and limits to plant protection products. Stocking densities are also restricted under meadow orchard management and must not exceed 1.9LU/ha. In conjunction with limits to livestock densities no excess of livestock manure can be produced and the quantity of nitrogen fertiliser used should not exceed 150kg/ha/yr.

Source: own screening of RDPs 20017-2013

Agri-environment schemes for organic support

Farmers in most Member States have the option to enter agri-environment agreements for the conversion to or maintenance of organic farming practices which address all the common themes in preservation of biodiversity. The high importance of organic farming for biodiversity is discussed in Chapter 2. The organic management options are used both in semi-natural grazed habitats and in the agriculturally improved cropping systems. They are the most frequently used type of agri-environment scheme across the EU-27 and receive a considerable proportion of agri-environment funds (European Commission, 2010a). In most Member States, farmers receiving payments for organic farming have to fulfil additional requirements beyond the organic standards and cross compliance requirements that are pertinent for the provision of biodiversity. Further reductions in N-fertilisers, grazing and cutting regimes, restrictions on irrigation and drainage etc are examples of such prescriptions. There is an array of additional ways in which Member States link the organic support with agri-environment payments for, for example, grassland conversion or the maintenance of landscape features and other biodiversity management. In the Mediterranean there is a focus on linking the organic support to the agri-environment payments for traditional crop varieties and endangered livestock breeds, while in Slovenia, Poland and the Czech Republic it is linked predominantly with grassland management and biodiversity management options. Other packages of Pillar 2 support to farms using the organic management option involve, in some Member States, encouragement of tourism, Natura 200 payments or farm modernisation (Schwarz *et al,* 2010).

3.3.2 Other CAP Pillar 2 measures

Other Pillar 2 land based measures and non-productive investments

Using the agri-environment measure in combination with other CAP Pillar 2 land-based area payments for delivering biodiversity outcomes is highlighted as particularly important in some regions of the EU-27. In some Member States, the Natura 2000 payments and the compensation measure for 'less-favoured areas' (LFA payments), have proved important in complementing agri-environment management and enhancing the effectiveness of measures for delivering biodiversity benefits within a broader sustainability perspective compared to them being used in isolation (Czech and Romanian case studies; Redman, 2010; Čierna-Plassman, 2010). Using measures in combination is reported to deliver combined benefits both for biodiversity and for the continuation of agriculture. In doing so, particularly in more remote areas where the economic viability of farming is under pressure, the use of the LFA payments in particular, but also the Natura 2000 measure, is reported to send an important message about the social value of farming in these areas and highlight a certain societal recognition and commitment to their ongoing economic viability. The Czech case study reports, for example, that farmers in Natura 2000 areas claim that without the combined agri-environment and Natura 2000 support, it would not be feasible for them to continue their employment in agriculture. The Baden Württemberg and Greek case studies underline the importance of linking the use of the agri-environment measure with the Natura 2000 and the LFA measures to ensure that sufficient support is provided to less affluent and less profitable farms in HNV farming systems.

Although the delivery of biodiversity benefits is not the primary focus of LFA payments, nonetheless it can have an important impact, particularly in relation to maintaining semi-natural habitats in upland areas and areas facing other natural constraints. It provides per hectare payments to compensate farmers in the areas with natural handicaps in mountains; in areas which experience constraints on production such as poor soils and climate where maintaining extensive farming is important for management of land; and in areas with specific handicaps and where it is a priority to maintain agricultural management to conserve or enhance the environment, maintain the countryside and preserve the tourist potential of the area. Member States have the scope to differentiate the payments depending on the severity and the nature of handicaps which could be potentially used to enhance the payment in HNV areas, for example. Indeed, many farmers managing HNV land receive the LFA payment and this is reported to have helped prevent abandonment of these areas (Keenleyside and Baldock, 2006). However, the biodiversity benefits of the measure are generally associated with the maintenance of low-input grazing management that tends to be found in mountain and marginal areas. The degree to which biodiversity benefits are achieved, however depends on the way in which the payments are implemented by Member States (IEEP, 2006). For example, there is potential for Member States to include specific environmental criteria and conditions in defining the areas and this has not been sufficiently employed to date. The same is true in relation to the possibility to define eligibility criteria to limit payments to certain forms of production, offer higher payment rates per hectare for small farms or to better differentiate the range of handicaps faced by different farm types and the location of farms (Keenleyside and Baldock, 2006; Beaufoy and Marsden, 2010). Very often though, in order to offer sufficient support to secure beneficial management in LFA areas, an LFA payment is required to compensate for the natural handicap as well as an agri-environment payment to support the appropriate land management.

The non-productive investments measure is another key measure that is used in combination with the agri-environment measure to secure the delivery of biodiversity benefits. Non-productive investments can be used to enable farmers to undertake capital works on their land, which are not linked to production, for example to clear scrub from unused land, to plant hedges, erect fencing, block drains etc. As underlined above, these sorts of actions are particularly important to be used alongside agri-environment area based payments for habitat restoration and habitat enhancement (for example blocking drains to recreate wet grasslands, see Box 9. The re-creation and restoration of traditional biotopes such as wetlands through non-productive investments have proved very important also for enhancing ‘ordinary’ biodiversity in degraded improved habitats. Some Member States also use other capital investment measures for this purpose, depending on the nature of the capital investments needed (for example, investments for infrastructure in agriculture and forestry and for conservation of rural heritage).

Pillar 2 measures to develop skills and capacity

Delivery of biodiversity through agriculture is knowledge-sensitive. It requires a combination of modern science with local knowledge of habitats and species and depends on scaling up experiences of locally adapted farming techniques and skills (UN, 2011). The development of an improved understanding in relation to, for example, the interactions between biodiversity and agriculture, regulatory requirements and decision-making skills in farmers’ communities, in lagging areas in particular, is therefore of paramount concern for the protection of farmland biodiversity (UN, 2011). Pillar 2 measures focussed on training, dissemination of information, extension services and advice are important measures in this regard. They can also be linked with some other Pillar 1 instruments such as the Farm Advisory System (discussed in Section 3.4). Their interaction with similar knowledge focussed actions addressing agriculture under other EU policies, especially the LIFE+

programme (discussed in Section 3.6) through voluntary rural development initiatives, and investment in collaboration and encouragement of partnerships (discussed in Section 3.7) is an important means of improving the local socio-economic commitment to delivery of biodiversity.

Pillar 2 measures to encourage farm modernisation and the economic viability of farms and rural areas

The delivery of biodiversity goals is dependent on the availability of labour, modern farm infrastructure and a minimum level of other local services, such as water and waste water services, sustainable electricity, roads, diverse local economies and markets. The availability of these services is tightly linked with the economic viability of farms and rural areas more generally. Issues with the existence of these services persist in many regions of the EU-27, particularly in 'lagging areas' and funding is needed to improve the situation. A range of CAP Pillar 2 measures are essential in this regard, such as those available to farmers to strengthen access to capital, access to markets, access to rural infrastructure and the re-structuring of semi-subsistence farms. All such measures reinforce the maintenance of land management activity in more remote areas by preventing cessation of agricultural activities, with benefits for biodiversity (Čierna-Plassman, 2010; Redman, 2010; Mantino, 2011; UN, 2011). Examples of the measures that can be beneficial include capital investments for farm modernisation and infrastructure, as well as investments to support farmers to join food quality schemes, the restructuring of semi-subsistence farms, diversification into non-agricultural business activities, encouragement of sustainable tourism and development of local plans, strategies and mapping tools for the conservation of natural heritage (see Box 13).

Box 13: Examples of schemes to encourage farm modernisation and the economic viability of farms and rural areas

Farm diversification: The 'Bee-Adventure World' is a project in Austria that is funded under the Rural Development policy developing a farm shop and facilities for training and demonstrating bee-keeping, carrying out bee-conservation works and offering teaching programmes to school groups and tourists, with the aim to diversify farm income and raise awareness of the benefits of pollination and bee-keeping for agriculture.

Creation and development of micro-enterprises: The 'Local Food Svartådalen' project in Sweden established a producers' network to facilitate access to local products for shops and restaurants and raise awareness and capacity to produce quality local food through seminars and courses.

Conservation and upgrading of the rural heritage: A rural development project for 'conservation and restoration of the natural and cultural heritage of wetland sites in Malta' which includes actions to develop management plans for the protected salt marshlands and improve the ecological status of the 'garigue' shrub habitat typical for the Mediterranean. The local rural biodiversity, rural communities and tourism all benefited as a result of this project.

Source: ENRD project website

Pillar 2 measures to support local participation and capacity building

The participation and active engagement of farmers is vital to encourage biodiversity management that is sustainable in the longer term, potentially beyond the lifetime of a particular project or should public funding no longer be available. The Leader approach aims to encourage farmers to identify innovative solutions and use their expertise to complement more formalised policy and science expertise and therefore has a strong potential to deliver innovative bottom-up projects that benefit areas of HNV farmland and 'lagging areas'. The focus of Leader projects in the past on capacity building for added value products beneficial for biodiversity, organic farming, marketing of local and quality food, beneficial land management at the landscape scale, development of Natura 2000 management plans and transnational projects aimed at protected cross-border habitats proved helpful to biodiversity goals (Cooper *et al,* 2006; Beaufoy & Marsden, 2010; Redman, 2010). Without doubt, experience with the Leader approach has had a strong influence on the degree to which the potential of participatory approaches has been explored in new Member States where farmers' associations often were not included in decision making processes previously. Recent voluntary initiatives and participatory projects funded through LIFE+ that aim to maintain HNV habitats or to restore degraded semi-natural areas and simultaneously reduce rural poverty, discussed in Sections 3.6 and 3.7, often utilise Leader approaches. Examples of projects supported through the Leader approach with a focus on biodiversity are provided in Box 14.

The LHowever, it is not easy to assess the overall contribution of past LEADER projects to biodiversity goals, as the projects often had qualitative objectives, such as enhancing social capital in rural areas, getting local actors and stakeholders to act together more effectively and improving the quality of life in rural areas. These objectives cannot be measured in a straightforward way (ELARD, 2011). Some caution is also needed in estimating the biodiversity achievements on the ground because there has been little rigour so far in setting objectives of actions, their focus on biodiversity was often diffuse and local action groups were sometimes dominated by individuals without in depth ecological expertise (European Court of Auditors, 2010a; Mantino, 2011).

Box 14: Examples of the LEADER projects 2000-2006 with a biodiversity focus

A number of Local Action Groups (LAGs) have been initiated by groups of farmers in different countries wanting to diversify into more ecological farming and direct marketing. They have used LEADER projects to develop local marketing of their products and to build their capacity for economic and environmental management.

- The Cumbrian LAG, **UK**, has built up a significant production capacity and markets for local and specialty food sold directly to consumers and has enabled Cumbrian farmers to continue extensive grazing systems with local breeds as well as to convert to organic production.
- The Miselerland LAG, **Austria**, included a food project that improved the nutrition of local children and stimulated demand for local high quality organic food.

Many successful LAGs have benefited biodiversity through the development of sustainable ecotourism strategies and improved public awareness and appreciation of biodiverse habitats.

- The Ourthe Moyenne LAG, **Belgium**, developed a sustainable tourism strategy based on improved environmental management of the river Ourthe. Direct benefits for biodiversity include improvement in aquatic environment through environmentally sensitive fishing management and indirect benefits include a visitor centre and ecotourism activities centred on the river.
- The LAG Associación País Románico, **Spain**, enabled the establishment of a Natura 2000 site Las Loras. It created a strong partnership of neighbourhood associations and other local stakeholders, and also created an association to promote the importance of fund allocation to reserve management within the regional and national government.

Source: adapted from European Communities, 2007; European Communities 2009.

3.4 Effectiveness of CAP Pillar 1 measures for delivery of biodiversity

This section reviews the impact on biodiversity delivery of the main CAP Pillar 1 measures relevant for this purpose - direct payments and cross compliance. The discussion of cross compliance addresses particularly those GAEC standards with a direct focus on biodiversity as well as the obligation for Member States to protect a proportion of permanent grassland. Furthermore, the eligibility issues associated with direct payments which arise, particularly in semi-natural habitats, are considered. Other Pillar 1 measures which have an impact on biodiversity, but for which there is less information available are addressed in less depth, namely Article 68 and the Farm Advisory System. Proposals for the 'greening' of Pillar 1 direct payments have been proposed by the Commission for the 2014-2020 CAP and these are considered further in Chapter 6.

3.4.1 Pillar 1 direct payments

Biodiversity goals associated with agricultural habitats interact with current Pillar 1 direct payments in several ways. Direct payments can be an important source of income helping to prevent land abandonment or its conversion to non-agricultural use and as such may contribute to the basic management of some habitat features. In addition, in some Member States where the partial 'coupling' of Pillar 1 payments to specific types of production remains, certain benefits can be produced for habitats where livestock grazing is an essential element of the management required to maintain species diversity, as discussed below.

However, the Pillar 1 direct payments do not have explicit environmental objectives and, given the link to cross compliance, their effect on biodiversity flows from the way in which they influence the behaviour of farmers and bring about changes in farming activities which affect habitats and species. Their precise effect on biodiversity on the ground is unknown, given the lack of recent monitoring and evaluation studies on the environmental impacts of these payments. In the past, direct payments were coupled to production and as a result drove overgrazing in some areas (Spain and the UK in particular) and led to the degradation of habitats and biodiversity loss in arable systems, for example through the removal of landscape features such as banks and hedges (Alliance Environnement, 2007a; Alliance Environnement 2007b). Under the decoupled payments system, although these payments themselves no longer have a direct impact on production levels at the farm level, other agricultural and non-agricultural factors than Pillar 1 payments continue to drive changes in the behaviour of farmers and changes in farming activities, as discussed in Chapter 2. This makes it difficult to be precise about the causality of impacts and assess the role paid by direct payments under CAP Pillar 1.

To some extent, the way in which the Single Payment Scheme is implemented can have an impact on biodiversity management. From the different options for direct payments resulting from the 2003 CAP reform, four of the EU-15 Member States (Germany, Ireland, Luxembourg and the UK) chose to fully decouple direct payments from production and pay these as a per hectare payment. Other EU-15 Member States have decoupled some payments and converted them to area payments as above, but have left some other direct payments (including for the beef and sheep and goat sectors) as coupled in the form of a headage payment. Decoupled payments under the Single Payment Scheme (SPS) in EU-15 are administered either as ‘regional’ flat rate payments or as payments based on ‘historical’ entitlements. EU-12 Member States (except for Slovenia and Malta) implement per hectare direct payments under the Single Area Payment Scheme (SAPS). An example of the impact of coupled premia for suckler beef, sheep and goat on biodiversity is presented in Box 15. Additional payments under Article 68 of Council Regulation 73/2009 are currently implemented by nearly all Member States (except Luxembourg, Malta, Cyprus), using up to 10 per cent of their total direct payments envelope, to encourage specific types of farming which are important for the environment, quality production and marketing and/or to buffer the consequences of decoupling of support in particularly sensitive sectors.

Box 15: Example of the impact of coupled payments in beef, sheep and goat sectors on biodiversity

Suckler beef premia have been retained only in France, Spain, Belgium, Netherlands, Austria and Portugal and **sheep and goat premia** in France, Spain, Denmark, Portugal, Finland, Slovenia, Greece. Maintaining sheep and goat premia reflects concerns about the need to ensure the continuation of the extensive systems grazed by goat and sheep in these Member States driven primarily by social purposes (Renwick *et al,* 2008).

The impact of the coupled beef, goat and sheep premia on biodiversity is not straightforward. For example in **Spain**, suckler beef farms have been making good profits, even in mountain areas where grazing takes place on common land. By contrast, sheep and goats are much less profitable and more labour intensive, as they require shepherding in most areas. Yet, the historic CAP headage payments for sheep and goats were always much lower than that for suckler beef and there was a strong tendency for sheep and goats to be replaced by beef cattle. In mountain grazing, use of unshepherded cattle is reported to be the cause of local overgrazing in the areas of best grass, accompanied by scrub invasion, leading to increased fire risk, in other areas. Given these trends, the 50 per cent coupling of sheep and goat payments is likely to be unable to stop abandonment of more remote mountain grasslands and common grazing in some lowlands used by sheep and goats.

Source: (Keenleyside and Baldock, 2006).

3.4.2 Pillar 1 cross compliance

Pillar 1 cross compliance was introduced as a mandatory tool in 2005 with a dual purpose. It aims to contribute to sustainable agriculture on the one hand and to mitigate potential undesirable effects of the transition to decoupled payments, primarily the risk of the cessation of agricultural land use and land abandonment on the other. As such, it has the potential to contribute to the delivery of basic management that is beneficial for biodiversity. It sets the dividing line between management which must be carried out at the cost of the farmer in keeping with the ‘polluter pays principle’ and voluntary action for which farmers are entitled to receive payments, for example under agri-environment contracts.

Overview of the scope of Pillar 1 cross-compliance focussed on biodiversity

The following elements of cross compliance have a direct focus on biodiversity:

- Statutory management requirements (SMRs)[18] related to the Birds and Habitats Directives,and the Nitrates Directive regarding the protection of water;
- Good agricultural and environmental condition (GAEC)[19] – certain standards as set out in Box 16;

[18] Article 5 and Annex II of Council Regulation 73/2009.

- Permanent pasture quantitative requirements, binding on Member States[20].

The purpose of the **SMRs** is to create a conditional link between the receipt of direct payments and compliance with pre-existing EU directives and regulations which apply at farm level. This means that SMRs can deliver only those biodiversity benefits that correspond to the legal baseline. Alongside the SMRs which are directly focussed on biodiversity, ie those associated with the specific articles of the Birds and Habitats Directive applicable at farm level, the SMR standard related to the Nitrates Directive is likely to have a positive impact, although it has no direct focus on biodiversity. The impacts of these legislative requirements are discussed in Section 3.2.

Within the suite of **GAEC standards,** several standards which affect both semi-natural and improved habitats have a direct focus on biodiversity (see Box 16). The whole suite of GAEC standards was revised as a result of the 2009 CAP Health Check into mandatory and optional requirements. As regards the latter, these GAECs are considered optional except where pre-existing minimum requirements were in place, such as a relevant GAEC standard existing before 1 January 2009 or relevant national rules. The optional standards are then established at the discretion of the Member State authorities. The flexibility for Member States to design both mandatory and optional GAEC standards seeks to 'take into account the specific characteristics of the area concerned, including soil and climatic conditions, existing farming systems, land use, crop rotation, farming practices and farming structure' (Article 6 of Council Regulation 73/2009). This provides the flexibility needed to allow standards to be developed to address local biodiversity needs and allow national and regional priorities to be reflected.

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[19] Article 6 and Annex III of Council Regulation 73/2009.

[20] Article 6(2) of Council Regulation 73/2009.

Box 16: GAEC standards with a direct focus on the provision of biodiversity

Compulsory standards directly focussed on the provision of biodiversity benefits include:

- *The retention of landscape features*, including hedges, ponds, ditches and trees growing in lines, groups, isolated or in field margins; retention of terraces; prohibition on grubbing up olive trees and maintenance of olive groves and vines in good condition;
- *The protection of permanent pasture;* and
- *Avoiding the encroachment of unwanted vegetation* on agricultural land.

Optional standards directly related to the provision of biodiversity benefits include:

- *Retaining terraces;*
- *Minimum stocking rates or appropriate regimes* (linked to both intensification and under-management and to the management of permanent pasture);
- (From 2010) *establishment or retention of habitats* is a potential means of creating or preserving connectivity in habitats, permanent grassland, especially in areas of intensive agricultural habitats; and
- *Crop rotation* requirements provide the opportunity for Member States to specify conditions that can improve conditions for biodiversity by encouraging the increase of permeability of the landscape.

A group of other GAEC standards focussed principally on *soil* (for example, soil organic matter, arable stubble management and soil erosion) will also have an indirect impact on soil biodiversity.

The compulsory standard for the *establishment of buffer strips* along watercourses is focussed principally on water objectives, however, it could help to reduce water pollution by nutrient run-off and thus improve the biological quality of aquatic habitats and wetlands, as well as providing new linear patches of grassland. It should be noted that a buffer strip designed under the GAEC standard for water pollution objectives will have a lower effectiveness for biodiversity than a field margin that is designed for delivery of benefits for habitats and species specifically.

Source: adapted from Annex III of Council Regulation 73/2009

The **quantitative permanent pasture requirement** is formally intended to avoid potential damage to European grasslands through limiting large-scale conversion to arable or abandonment after the introduction of decoupled payments. It obliges Member States to maintain the relative proportion of permanent pasture at the reference level recorded in 2003-2005[21]. A tolerance of 10 per cent is permissible and this allows some decrease in the proportion of permanent pasture, while within this tolerance no corrective measures at farm level are required for the re-conversion of arable land into permanent pasture. The measure addresses all permanent pasture declared for direct payments[22], not specifically semi-natural pastures, which are of particular value for biodiversity.

Impact of Pillar 1 cross compliance on delivery of biodiversity

The most recent evaluation of the impacts of cross compliance standards on biodiversity at a pan-European scale was published in 2007 (Alliance Environnement, 2007a). One of the general findings of the study was that the conservation of birds and habitats and the minimum level of maintenance of habitats are less well addressed by cross compliance obligations in Member States than other environmental issues. Since then, many changes

[21] Article 6(2) of Council Regulation 73/2009.

[22] 'Permanent pasture' is defined as land used to grow grasses or other herbaceous forage naturally (self-seeded) or through cultivation (sown) and that has not been included in the crop rotation of the holding for five years or longer' (Council Regulation 796/2004).

have been made to the implementation of cross compliance, such as the gradual increase in the implementation of the environmental legislation in the majority of the new Member States, changes in both the SMR and the GAEC elements resulting from the 2009 CAP Health Check and the introduction of new GAEC standards in many Member States. Because of these changes, the detailed findings of the evaluation regarding specific implementation issues are now outdated.

A number of the observations made in the 2007 report remain valid, however. One of these concerns the difficulty of separating out any additional effect of **SMR cross compliance** on farmers' behaviour, because the legislative measures of individual SMRs are binding at farm level irrespective of whether or not direct payments are claimed and irrespective of cross compliance enforcement. The only legal change is that for farmers claiming direct payments there is the potential loss of direct payments in addition to any legal penalties under primary legislation, and the evidence suggests that this has raised farmers' awareness of their legal obligations (European Commission, 2010f). Mandatory inclusion of information on cross compliance as part of the Farm Advisory System has been one of the main reasons for farmers' increased awareness of obligations that they have under the Birds and Habitats directives. However, it remains unclear whether or not overall compliance with regulations has also increased. Doubts remain about this as inspection rates are low, at only one per cent and some infringements continue to be found (European Court of Auditors, 2008).

From 2005, **GAEC standards** have been mandatory on the whole farm, whether the farmers receive direct payments or not. These standards apply not just to the area of land that is eligible for direct payments, but the total area of the farm. If the GAEC standards are implemented well, their mandatory character should help prevent both intensification and under-management of semi-natural habitats. The types of management addressing the maintenance of semi-natural landscape features and avoidance of overgrazing and undergrazing are particularly relevant here. They are encompassed within the GAEC standard to ensure a 'minimum level of maintenance' over the farmed area. They include the compulsory measures for 'retention of landscape features', 'avoiding the encroachment of unwanted vegetation on agricultural land' and 'protection of permanent pasture' and the optional standards for 'minimum livestock stocking rates or/and appropriate regimes' and 'establishment and/or retention of habitats'. However, there is lack of clarity about impacts of GAEC cross-compliance on land where no direct payments are claimed or which are ineligible for direct payments because this often coincides with land at risk of abandonment. Although no recent evaluation is available regarding biodiversity impacts of GAEC cross-compliance at the pan-European level, there is some indication that the the standards can deliver highly beneficial effects in semi-natural habitats as they provide guidance for good management. Some of them are illustrated by examples from the case study areas as set out in Box 17.

Box 17: Examples of GAEC standards for minimum level of maintenance relevant for grazed semi-natural habitats

England - The aim of the GAEC 'minimum livestock stocking rates or/and appropriate regimes' is used to prevent over-grazing. The standard sets out a requirement to protect important natural and semi-natural grazed habitats, including heathland and moorland, unimproved grassland, grazed woodland or forest and sand dunes. No stocking densities are set, because optimal stocking rates vary with the location, type and current state of the habitat. Farmers must not graze so many livestock that the growth, quality or diversity of natural or semi-natural vegetation is adversely affected or provide supplementary feed for livestock in a way that adversely affects the quality or diversity of natural and semi-natural vegetation through trampling or poaching of land by livestock, or by ruts caused by vehicles used to transport feed. A standard on EIA, re-enforcing existing legislation requires farmers/foresters to get permission before carrying out an agricultural project to intensify uncultivated semi natural land for agricultural purposes or afforestation/deforestation proposals. A ban on ploughing permanent pasture at farm level is also in place.

France -- Under the GAEC standard for 'minimum livestock stocking rates or/and appropriate regimes', the undergrazing requirement for pastures involves a minimum stocking density of 0.2 LU/ha, calculated on the grass area of the farm. For meadows a locally adapted minimum yield level is set out. Both limits can be locally adapted for less productive areas. There is a ban on converting permanent pasture into arable at the farm level.

Czech Republic – Under the GAEC standard for 'protection of permanent pasture', there is a ban on converting permanent pasture into arable at farm level.

Greece – Under the GAEC standard for 'minimum livestock stocking rates or/and appropriate regimes', both over-grazing and under-grazing limits are set out as part of the GAEC standards. The minimum level of grazing density is 0.2 LU/hectare and the maximum level 3 LU/hectare. The upper limit is meaningless on semi-natural pastures as grazing levels are rarely this high and it therefore does not appear to provide any level of protection against the intensification of grazing. There is a provision that permanent pastures must not be ploughed, except for environmental or archaeological reasons.

Romania – The GAEC standards for 'minimum livestock stocking rates or/and appropriate regimes' and 'protection of permanent pasture', require the maintenance of permanent pastures by ensuring a minimum grazing level or by mowing them at least once a year. There is also a ban on burning grass from permanent pasture.

Source: GAEC notifications by Member States to the European Commission (2010); case study reports (2011).

Of the cross compliance requirements focussed on biodiversity that have been thoroughly debated since 2003, the quantitative permanent pasture requirement for Member States has received much attention. Its purpose was to maintain a proportion of land under permanent pasture at the national level, specifically at least 90 per cent of the share of permanent grassland in 2003-2005[23]. When it was introduced, the aim of the quantitative obligation was to safeguard the environmental benefits of permanent pasture and limit a large scale loss of permanent grassland to arable in highly productive areas[24]. However, it has become clear that the requirement is able only to minimise the rate of decline of permanent pasture and its conversion to arable to some extent. The evidence suggests that without this requirement, loss of permanent grasslands would progress at a much greater pace in some Member States (for example, Germany), whereas it has had less influence in other Member States (France, England and Spain).

Whilst this quantitative requirement focuses on all permanent pasture, to ensure the protection of semi-natural habitats Member States have to use other measures to make a qualitative distinction between different types of permanent grassland, for example by

[23] Article 6(2) of Council Regulation 73/2009 and Article 3.2 of Council Regulation 796/2004 as amended. The baseline year varies between Member States. The total land under permanent pasture is understood in the sense of 'utilised agricultural area' , ie referring only to permanent pastures that are eligible for payments.

[24] Recital (7) of Council regulation 73/2009 envokes the need to encourage the maintenance of existing permanent pasture against 'a massive conversion to arable land'.

applying additional locally-specific qualitative requirements under the GAEC standards on ‘protection of permanent pasture’ and ‘minimum stocking density and appropriate regime’ (as in the UK and France, see Box 18); by using agri-environment schemes to ensure the ongoing management and maintenance of semi-natural habitats or by using other measures such as nature conservation legislation (as in Austria, Germany, Italy and the UK). As discussed in more detail in Section 3.2, the EIA Directive has certain provisions to address the protection of semi-natural grasslands as well, however they remain theoretical in many instances, given implementation in practice.

Certain doubts have been raised about the biodiversity effects of the permanent pasture quantitative requirement on Member States (under Article 6(2) of Regulation 73/2009), because in the absence of other qualitative guarantees described above, the rule allows farmers to abandon or convert pasture to arable in more marginal locations and create new and less environmentally valuable pastures from arable land in others (European Court of Auditors, 2008; Birdlife International, 2009; Oppermann, 2009). Other doubts have been expressed about the fact that the focus of the rule is on the protection of only those permanent pastures that are declared or eligible for Pillar 1 direct payments, and only those pastures that are defined as predominantly ‘herbaceous’[25], with the consequence that biodiverse pastures with trees or shrubs are not included in the baseline of the share of permanent pasture to be kept at national level. The detailed points of these criticisms are set out in Box 18.

[25] Article 2 of Council Regulation 796/2004 defines permanent pasture as a ‘herbaceous’ habitat: ‘*land [that is] used to grow grasses or other herbaceous forage naturally (self-seeded) or through cultivation (sown) and that has not been included in the crop rotation of the holding for five years or longer….*’[25]. This definition of ‘permanent pasture’ differs from the definition used in land accounts by Eurostat.

Box 18: Issues of effectiveness of the quantitative requirements on Member States to maintain a proportion of land under permanent pasture

Link to direct payments. The rule aims to protect a ratio of permanent pastures that are eligible and declared for direct payments, thus it does not necessarily apply to all permanent pasture. In some Member States a significant area of semi-natural habitats are either not eligible for direct payments, for example because the farm size is too small, due to the presence of vegetation and trees, or because it is not declared for direct payments by the farmer. Examples of countries where there is evidence that this is an issue include Northern Ireland, Scotland, Sweden, Estonia, Slovakia, Romania, Bulgaria and Spain.

Definition of permanent pasture. Because the definition of permanent pasture in the CAP regulations focuses on pastures which are 'herbaceous', the definition excludes some of the most valuable semi-natural grasslands with trees and scrub (Northern Ireland, Scotland, Sweden, Estonia, Slovakia, Romania, Bulgaria and Spain).

Quantitative character of the requirement. The requirement does not seek to address the botanical value of the pasture. In several countries, the majority of the permanent pasture is of limited value for biodiversity (for example Belgium, Denmark, Netherlands and the UK-England). Other policy instruments dedicated more directly to the protection of grasslands with a botanical value are poorly implemented, ie the national legislation transposing the Habitat Directive (Article 6.3 and 6.4), the EIA Directive and the GAEC standard on protection of permanent pasture under 'minimum maintenance of land'.

Lack of consolidated data. At least one Member State (Spain) is known to have a considerably lower area of permanent grassland (as defined in the Regulation) than the existing area of permanent pasture used for grazing, whilst this declaration respects the formal rules for direct payments. The difference has to do with the fact that farmers are using more land for grazing than they need to declare to activate direct payment entitlements. Permanent pasture under Article 6(2) rule is 7.1 Mha in 2010, Spain's national farming statistics record 8.65M ha and the national forest strategy estimates permanent pasture to be in the region of 20Mha. This figure includes pastures under grazing, including grazed and browsed woodlands and scrub, but not pastures under exclusive forestry use. The under-declaration opens room for trends in semi-natural habitats that have the potential to undermine the biodiversity targets, such as abandonment or conversion to other land uses, which will go unnoticed in the official statistics.

Source: Case study reports; Alliance Environnement, 2007a; BirdLife International, 2010; Čierna-Plassman, 2010; King, 2010; Redman, 2010; Cumulus Consultants, 2011; Beaufoy *et al,* 2011.

3.4.3 Pillar 1 eligibility rules

The agricultural land that is currently ineligible for direct payments includes some of the most extensively managed and ecologically valuable permanent pastures, including those listed under the Birds and Habitats Directive in Estonia, Bulgaria, Romania, Slovakia and Sweden and smaller but not negligible semi-natural areas in Scotland (scrub), Northern Ireland (heather moorland, thick hedges) and France (alpine meadows)[26]. There is a risk of cumulative adverse effects on biodiversity on land that is already undermanaged, often in 'lagging areas', if such land is excluded from direct payments and becomes prone to

[26] In Sweden, 60 000 ha of semi-natural pastures are not registered in LPIS because of trees and shrubs above the limit of the rules (ie 24 per cent Annex 1 habitats in need of agricultural maintenance in some parts of the country and 8 per cent of Annex 1 habitats in the whole country). In Estonia, 38 000 ha of semi-natural pastures (ie more than 30 per cent of the total area of these pastures) are ineligible because of number of trees or tree canopy. In Bulgaria, 703 384 ha of semi-natural grasslands (ie 62 per cent of total surface of semi-natural pastures) because of either non-compliance with 'good agricultural condition' in 2007; too small size of holdings (62 000 ha); other corrections by national authorities (279 548 ha); or non-compliance with the GAEC standard on 'unwanted vegetation'. The decisions about ineligibility are generally taken on the basis of satellite images rather than inspections of management activity.

overgrowth and abandonment (European Court of Auditors, 2011b), without the fact being captured in the official agricultural statistics.

Role of rules for eligible land

Since 2005 the rules for eligible land have played a major role in the above mentioned situations where farmers removed valuable vegetation in semi-natural habitats. These cases occurred when farmers sought to comply with the eligibility rules prior to declaring their land for direct payments, or in fear of the overly rigorous pursuit of the eligibility rules by national authorities (Birdlife International, 2010; King, 2010; Cumulus Consultants, 2011; Hart *et al,* 2011b). Because farmers are at real risk of losing direct payments when their agricultural land does not comply with the eligibility rules as applied at national level, they are strongly motivated to change their management to minimise this risk.

Particular problems in semi-natural habitats have been caused by differences in interpretation of the current definition of eligible area/parcel, including the technical advice provided by the Commission regarding the eligibility of hedges, ditches and other semi-natural features such as trees. After initial experiences with the implementation of decoupled payments, these definitions were seen as too strict. In response, the Commission explored these issues in 2009 and stressed in the clarified guidance that 'the issue of eligibility touches upon the fundamental question of what the first pillar of the CAP shall support' and therefore it has 'not only implications in terms of administration but also important political dimensions'. These political dimensions were deemed not possible to resolve through that technical exercise (European Commission, 2009b).

Whilst issues relating to eligibility have arisen particularly in those Member States that operate the SAPS, this is not the case exclusively. An overview of the eligibility rules under direct payments is presented in Annex 7 (p313). Under the SPS the eligible hectare has to be used predominantly for agricultural activities, even if non-agricultural activities (for example management for nature conservation) take place, and keeping the land in GAEC is understood as an eligible agricultural activity if other agricultural activities have ceased[27]. The issues that arise in Member States under the SPS therefore revolve, in some countries (for example Sweden), around the definition of the eligible area, that is whether or not the whole types of pastures characterised by presence of trees such as wood pastures are eligible and, in other countries (for example Northern Ireland, Scotland etc), whether landscape features such as hedges, shrubs, trees, ponds, etc can be counted as eligible. Secondly, they revolve around the maintenance of the area that is no longer under active agricultural production but maintained in GAEC, in particular with respect to the standards on minimum maintenance of land.

In the EU-10 Member States operating the SAPS, the eligible land must be a part of the utilised agricultural area and must have been in 'good agricultural condition' in 2003 whether or not it was in production at that date. In Bulgaria and Romania, compliance with 'good agricultural condition' is not linked to any fixed year and is re-activated annually[28]. However, there is no Community definition of 'good agricultural condition' in the legal text and it relies on interpretation by national standards. The issues arising in the EU-10 Member

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[27] Article 34(2)(a) and 2(c) of Regulation 73/2009 and Article 2(a) of Regulation 795/2004.

[28] Article 124(1) and (2) of Regulation 73/2009.

States therefore centre not only on the definition of eligible area and the eligibility of landscape features, but also, on the difficulty to resume eligibility for farms outside direct payments, in cases where the agricultural land was considered ineligible on the basis of satellite images in 2003, and the ineligibility of a high number of small farms. Additional issues arise in Romania and Bulgaria because of the need to comply with the standard for 'good agricultural condition' every year. Evidence appears to show that in some Member States, therefore, particularly when environmental authorities have less capacity, the setting of national standards for vegetation, landscape features and 'good agricultural condition' has ended up being at the disadvantage of low productive systems and semi-natural habitats (for example, in Estonia, Bulgaria).

Box 19: Issues arising in implementation of eligibility rules for Pillar 1 direct payments, with adverse effects in semi-natural habitats

Administrative and regulatory loopholes. There are several loopholes that complicate the eligibility of semi-natural farmland in Pillar 1 direct payments. They involve:

- eligibility of vegetation, trees and landscape features (for example in Bulgaria, Estonia, Sweden and Scotland);
- eligibility of small holdings (Bulgaria, Estonia, Romania, Slovakia);
- the absence of an EU-wide definition for 'good agricultural condition' (Bulgaria, Estonia, Slovakia); and
- lack of will by farmers to declare their land, for example in marginal livestock farms, motivated by concerns, about too burdensome or costly cross compliance obligations; this loophole also results from the lack of extension services, training, information and advisory targeting these farms (Bulgaria, Romania, Slovakia).

Issues arise particularly in the **implementation** of rules for the eligible area and their **interpretation** through national standards.

Additional administrative loopholes that have proved unhelpful for semi-natural habitats involve the interplay between eligibility rules and the **administrative management of areas** through the land parcel identification system (LPIS)[29]. The technical rules (for example the rule on trees and size of eligible landscape features) related to the LPIS are part of the challenge. Although the LPIS is a technical tool for the administrative management of areas and should merely enact the EU and national rules, in practice, the criteria used for the inclusion and exclusion of areas within the LPIS are linked to the eligibility criteria because the LPIS is used by farmers (in relation to declarations) and by national authorities (in relation to cross-checks) (European Commission, 2009b) The ways in which certain pasture types are recorded on LPIS is important, as the national implementation systems takes them as the basis for subsequent decisions on eligibility. For example, shrub pastures and tree pastures are recorded in Spain as an eligible category for SPS on the LPIS. In the large region of Castilla-y-Leon, these categories make up 40 per cent of all eligible farmland. Similar pastures in Bulgaria, Estonia and Sweden generally are recorded on LPIS as not eligible. Other loopholes involve interplay between eligibility rules and GAEC cross compliance, as discussed in Box 3-17.

Control and enforcement of eligibility rules play a significant role. On the one hand, control and audit is a vital part of any well-functioning policy, enabling policy makers and stakeholders to take account of problems in implementation, to correct them and to improve the policy or implementation when needed. On the other hand, when the policy requirements are not well-designed or implemented, penalties prompt farmers to pursue the rules more vigorously. In this case, some farmers have pursued management that has been

[29] Article 15(1)(c) and Article of Regulation 73/2009.

detrimental to biodiversity for fear of woody and scrubby land being excluded from direct payments. For example, the audit findings on 'ineligible' landscape features or trees[30] led to cases of farmers being penalised and land being excluded from direct payments in Northern Ireland and Sweden. In Sweden, the national rule on 50 trees per hectare was subsequently adopted and applied in protected wooded pastures, after widespread concern with damage undertaken by farmers to avoid further penalisation. In Northern Ireland, after the findings of the EC audit, farmers pursued the rules on vegetation and landscape features (width of hedges) in a more stringent way because they were required to do so by the imposition of a stricter national standard, and in Scotland, farmers removed semi-natural vegetation on their own initiative, in anticipation of risks of penalisation.

Room for improvement. After widespread political concern, Sweden, Estonia and Bulgaria have adapted their national technical standards, for example by allowing 75 trees per hectare instead of 50. Estonia and Sweden also adopted an agri-environment scheme to address the management needs in wooded pastures that were excluded from direct payments.

Source: adapted from Čierna-Plassman, 2010; King, 2010; Beaufoy, *et al* 2011.

Role of eligibility rules associated with the GAEC standards

As discussed above, the primary focus of the GAEC standards for 'avoiding the encroachment of unwanted vegetation on agricultural land' and 'retention of landscape features' is to ensure a minimum level of maintenance and avoid the deterioration of habitats. These standards are not therefore defined as a direct part of the Pillar 1 rules concerning eligible area. However, when controls find non-compliance involving vegetation such as scrub, shrubs, trees, bramble, patches of gorse, thick hedges, and water bodies above the limits set in the national standard, these semi-natural features become excluded from direct payments and the parcel of land covered by these elements becomes ineligible for payments. As illustrated in Box 20, provisions exist in some Member States for the standard for 'avoiding the encroachment of unwanted vegetation on agricultural land' that promote good and reasonable practices on the ground. In other Member States, the standard was implemented in a way that unintentionally had severe detrimental effects on semi-natural vegetation, either in the form of abandonment of the land where the costs of compliance with GAEC are greater than the rewards from farming the land in question or in removal of vegetation. For the future, there would be value in providing greater clarity in the regulation and technical guidance on the meaning of this GAEC standard and institutional capacity at all levels should be improved to avoid misinterpretations that lead to environmentally damaging implementation in the future.

[30] Article 21 (1) of Regulation 73/2009 specifies that when 'a farmer does not comply with the eligibility conditions... *the payment or part of payment granted ... shall be subject to the reductions and exclusions*'. Article 21 (2) state that reductions will correspond to '*severity, extent, permanence and repetition of the non-compliance found and may go as far as total exclusion from one or several aid schemes for one or more calendar years*'.

Box 20: Good practice and eligibility issues relating to the implementation of GAEC standards for 'avoiding the encroachment of unwanted vegetation on agricultural land' and 'retention of landscape features'

Good management prescriptions in some Member States. In France this GAEC standard involves locally adapted rules with management prescriptions which must allow for flowering, for minimum vegetation cover and maintenance of fallow land. For example forage areas should allow for extensive and rough grazing, moorland and woodland, including those with more than 50 trees per hectare if they have grass cover, shrubs or fruit that are consumable, accessible and actually grazed or browsed by livestock. In England GAEC management provisions regulate heather and grass burning, require weed control, and require a minimum mowing regime on unused land including a provision over the nesting period; and in Baden-Württemberg a requirement for a minimum mowing regime on unused pastures exists.

Unhelpful implementation in other Member States. A vigorous pursuit of some management prescriptions under this GAEC standard have been reported with detrimental outcomes for biodiversity. The standard appears to be so strictly interpreted in some Member States that farmers cut trees, or remove natural vegetation or landscape features that are important from the viewpoint of environmental protection of semi-natural habitats for fear of a reduction of direct payments. In the past this issue was often combined with issues arising from application of a technical eligibility rule, for example on trees per hectare or width of hedges (Scotland; Northern Ireland).

Damage reported. Removal of thick hedges and dense scrub (Northern Ireland), removal of valuable scrub, trees and bushes from undergrazed/underutilized HNV areas inside and outside Natura 2000 sites (Bulgaria).

Progress underway. Environmental stakeholders from the affected areas are collecting evidence and addressing the national agricultural authorities to explain the unintended severe harm caused by the implementation of the standard to environmental objectives in semi-natural habitats.

3.4.4 Other CAP Pillar 1 and other CAP measures

Other CAP Pillar 1 measures which can benefit biodiversity are the voluntary schemes for specific types of farming which are important for the environment, quality production and marketing under Article 68 of the Council Regulation 73/2009, obligations to Member States to establish and implement the Farm Advisory System (FAS) under Article 12, and the National Frameworks for voluntary environmental measures in the fruit and vegetable sector. All these measures receive a certain amount of funding from Pillar 1, except for the FAS, which can be funded partly from Pillar 2 advisory measures or national sources. Among other CAP measures, the funding provided under the Community programme on the conservation, characterisation, collection and utilisation of genetic resources in agriculture has a considerable potential to influence biodiversity in a very focussed way, by tailoring specific actions, such as the specific research to support plant, animal and tree genetic resources in agriculture. Box 21 provides more information on these CAP Pillar 1 and other CAP funding tools.

Box 21: Impact of other CAP Pillar 1 and other CAP measures with a direct or partial focus on biodiversity

Under the **Article 68**, ten Member States (Denmark, Finland, France, Ireland, Italy, the Netherlands, Poland, Portugal, Spain, Romania[31], and the UK-Scotland) chose to employ the options for special support to farming which is important for the protection of the environment (Art. 68 (1)(a)(i)) and for agri-environment benefits (Art. 68 (1)(a)(v)), including a range of actions such as extensive grazing, organic farming, maintenance of permanent pasture, crop rotations, and local breeds. These schemes can use up to 10 per cent of the total national direct payment envelope. Examples are the schemes for maintenance of extensive livestock practices in the Burren Natura2000 area in Ireland; for the maintenance of local breeds and extensive livestock in Portugal; and for the maintenance of extensive livestock and permanent pasture in Denmark. Member States are required to report on the impact of the Article 68 schemes on their objectives by October 12. However, with no specific objectives and no formalised indicators, the reporting requirement is not a substitute for proper monitoring and evaluation and is unlikely to provide the evidence needed to assess the outcomes of the schemes on the ground.

The **Community programme on the conservation, characterisation, collection and utilisation of genetic resources in agriculture** (2007-2013) includes actions for in-situ and ex-situ conservation of local breeds important in semi-natural pastures such as heritage sheep in the UK, France, Greece, Slovenia and the Netherlands. Although the evaluation of the current programme has not been carried out yet, the 1998 evaluation of the previous programme found that marginal ecological areas often benefitted most from the programme (Independent Expert Group, 2001).

The **Farm Advisory System** has been evaluated recently by the Commission. An important message underlined by the evaluators is that provision of advice did change awareness of environmental issues (water, soil and biodiversity) in farmers who received advice (European Commission, 2010f). Almost one third of farmers under survey (28 per cent) stated that biodiversity was the issue which made them change their view (ADE, 2009). However, the advisory issues directly relating to the GAEC cross compliance (soil/water) are seen by farmers as more important than those relating to voluntary management to promote biodiversity. This illustrates room for improvement in communication and dissemination of information on biodiversity issues to farmers.

Other CAP measures with a biodiversity focus include certain schemes under the EU food quality policy, geographical indications in particular. Although food quality policy has no direct focus on biodiversity, it can have positive impacts on local habitats because of the strong link required to the origin of the foodstuff. At the same time it can increase the competitiveness of the farms involved in these schemes and enhance economic viability of specific rural areas (Riccheri *et al,* 2006). In particular the schemes that include management requirements directly favouring local biodiversity and habitats in the registered product have proved beneficial, as illustrated in Box 22.

[31] In the case of Romania, a scheme for organic farming is supported under article Art 68 (1)(a)(ii), as a case of special support to farming important for improving the quality of agricultural products. Another case of support to organic farming under this measure (France) has been notified as a case of environmental support under Art. 68 (1) (a) (v).

Box 22: Examples of schemes registered under the EU Agricultural Quality product (PDO) with a biodiversity focus

The PDO scheme for **moor sheep meat** ('Diepholzer Moorschnucke') made profitable **semi-natural moorland and wetland habitats in Diepholz**, Germany, which would otherwise deteriorate. The scheme involves use of a local breed of sheep linked through a long history of grazing with the moorland and the Ramsar-listed wetlands. The involvement of environmental NGO helps to determine locally suited stocking rates. The management has contributed to the regeneration of more than 5,000 Ha of moorland. A number of endangered species, including sundew and wood lark, have recovered in the area, whilst the use of a traditional sheep breed enhances agro-biodiversity.

A very successful PDO scheme for **ewe's milk cheese** ('Idiazabal') from the **extensively grazed mountain habitats in the Basque and Navarra** regions, Spain, involves production methods based on careful grazing and traditional breeds *Laxta* and *Carranzana*. Transhumance and shepherding which has shaped the semi-natural habitats is maintained through the PDO scheme, as well as low stocking rates which have helped maintain a mosaic of mountain habitats and species.

The **traditional rice** varieties produced through the PDO scheme 'Arroz de Valencia' are cultivated within the protected **wetlands of the Albufera National Park i**n the region of Valencia, important for migratory and water birds. The production methods are tailored to the habitat, relying on variable flooding levels which sustain optimum wetland soil conditions, minimal use of agro-chemical inputs, etc. conditions have been retained providing habitat for species of plant, fish, amphibian, bird etc.
Source: Ecologic, 2006a; Ecologic, 2006b; Riccheri, 2006.

3.5 The effectiveness of the set-aside measure – the case of a re-designed policy response

The biodiversity benefits of the now abolished set-aside measure is worthy of elaboration. It is particularly relevant in the context of current attempts to introduce new GAEC and agri-environment provisions that aim to focus directly at delivering the environmental benefits that set-aside provided and, most recently, the proposals for greening Pillar 1 including a requirement for a proportion of the cropped area to be allocated as an ecological focus area. Although originally designed as a supply control measure, by requiring a proportion of cultivated land to be taken out of production, set-aside had considerable unintended beneficial impacts on biodiversity (IGER, 2005; Bracken and Bolger, 2006; University of Cambridge, 2006; Cumulus Consultants, 2007; Macdonald *et al,* 2007; Wretenberg *et al,* 2007; Curry, 2008; NABU, 2008; Boatman *et al,* 2011; Herzon *et al,* 2011; Kovács-Hostyánszki *et al,* 2011; Morris *et al,* 2011; Tscharntke *et al,* 2011).

Set-aside was introduced as a voluntary supply control measure on the land under cereals, oilseeds and proteins, and became an obligatory requirement for farmers receiving direct payments in 1992. Following the 2003 CAP reforms and the decoupling of direct payments from production, as well as for market reasons, the purpose of maintaining this production control measure was no longer justifiable and the 2008 CAP Health Check included a provision for its removal. In Member States with large areas of land subject to set-aside obligations in particular, such as Germany, England and Spain, the abolition of mandatory set-aside risked resulting in a significant loss of the environmental benefits that had accrued. Evidence demonstrates that these environmental benefits depended on a number of factors, for example whether set-aside was rotational; whether the land remained bare or vegetation was allowed to naturally regenerate or was sown during the fallow period; where it was located within the farm and whether it was applied as whole fields or as part-fields (in blocks or strips); and the way in which set-aside was managed, for example if herbicides were used to control weeds or vegetation was cut (IEEP, 2008).

Box 23: Biodiversity impacts of the obligatory set-aside measure

The obligatory set-aside measure proved particularly **favourable for providing wildlife habitat**. It introduced patches of wildlife into the farmed landscape, increased heterogeneity and provided habitat and feed sources for farmland birds (Sotherton 1998; Henderson and Evans 1999; Henderson *et al,* 2000a, b; Firbank *et al* 2003; Vaughan *et al* 2003; Bracken and Bolger, 2006; Hodge *et al* 2006; Curry 2008). A meta-analysis of 127 monitoring studies by Van Buskirk and Willi (2004) showed that the number of species of birds, insects, spiders and harvestmen, and plants were significantly higher on set-aside land than on nearby control areas under conventional agriculture.

The **reduction of diffuse pollution** as a result of reduced inputs such as pesticides and fertilisers (Cumulus Consultants, 2007) has become an additional indirect factor in maintaining and enhancing biodiversity of the set-aside land. Synergistic effects have been delivered also for the **prevention of soil erosion and improving soil structure** and fertility (Boellstorff and Benito, 2005; Cumulus Consultants, 2007), and for climate change mitigation and adaptation.

Results in **Germany** show that significantly more farmland bird species are breeding on set-aside than on arable land (42 species compared to 15 species). Set-aside has also been shown to have a beneficial effect on the population trends for Corn Bunting (*Miliaria calandra*) in Germany. The sharp population increase in East Germany between 1991 and 1996 is related to a large share of set-aside land (15-20 per cent of the arable area). The populations in West Germany have decreased considerably since set-aside land is being used for energy crop production (NABU, 2008).

In **Sweden**, Lapwing (*Vanellus vanellus*), Starling (*Sturnus vulgaris)*, Skylark (*Alauda arvensis)* and Linnet (*Carduelis cannabina)* all showed increased population trends during the main set-aside period linked to the higher abundance of weeds and insects (Wretenburg *et al,* 2007).

In **Ireland**, species diversity and the abundances of Skylark (*Alauda arvensis)*, Meadow Pipit *(Anthus pratensis)* and Woodpigeon were significantly greater in set-aside sites compared to adjacent tillage or grassland. Different species were found to exhibit different preferences for rotational and non-rotational set-aside (Bracken and Bolger, 2006).

In the 2007-2013 period, several RDPs included options within their agri-environment schemes to improve the management of set-aside for biodiversity purposes until it was abolished. The content, quality, potential to deliver, and payment level of the management actions across the RDPs differ. To mitigate the impacts of abolition of set-aside through the 2008 Health Check, several types of new policy interventions to promote 'ecological set-aside', more recently termed 'ecological focus areas' have been used, from the GAEC standard for minimum maintenance of land (France), to new agri-environment schemes with enhanced rotational fallow (Finland, Germany, France), and a national voluntary initiative (England) (Box 24).

Box 24: Ecological set-aside in post-2008 CAP policy measures

In 23 RDPs 2007-2013, 11 Member States include a form of environmental fallow in their **agri-environment** programmes. The majority of these management actions were designed and approved in 2007 when the obligatory set-aside still existed. Some new, specifically designed management actions were introduced in 2008 and later. The Member States are: Italy (Emilia Romagna, Lazio, Lombardia), Latvia, Poland (both in meaning of buffer strips/zones), Ireland, the UK (Northern Ireland, Wales), Finland, Sweden, France (Guyane), Luxembourg, Germany (Baden Wuerttemberg, Bavaria, Saarland, Saxony, Thuringia, Lower Saxony and Bremen, Rhineland Pflaz for old commitments), Spain (Aragon, Madrid, Basque Country).

Examples of set-aside initiatives within and outside the CAP taken after 2009 are as follows:
France has introduced a new **GAEC standard** for the minimum maintenance of land which allows the continuation of fallow management as a stand-alone option contributing towards several objectives including biodiversity.

Finland, Germany and France have developed new **agri-environment** management options within an enhanced crop rotation scheme.

In **England**, the industry-led **voluntary initiative** 'Campaign for the Farmed Environment' encourages farmers and land managers to voluntarily adopt important land management practices that will benefit the environment, in particular the environmental management of uncropped land. Unlike the obligatory set-aside, the scheme is monitored. The Campaign is seeking to establish at least a further 30 thousand hectares of voluntarily managed land (largely through increased uptake of the Entry Level Stewardship agri-environment scheme) and retain the area of un-cropped land at 179,000 hectares. If the target is not reached, the value of a more regulatory approach will be considered. A recent assessment suggests that certain management actions are providing benefits similar to those arising on set-aside, particularly those that are most similar to former set-aside (such as grass buffers alongside temporary and permanent watercourses; and reversion of arable areas), but success is highly variable. For example actions for keeping over winter stubbles proved to be the largest adopted action by area (61,000ha in the 2009/10 crop year) but had only mixed results with a large proportion being managed unfavourably for biodiversity (FERA, 2011).

3.6 Effectiveness of other EU policies for delivery of farmland biodiversity

3.6.1 EU LIFE and LIFE+ programme

There are a number of policy measures involving farmers and land managers under other EU policy instruments that can potentially enhance or complement measures under the CAP to enhance biodiversity provision. The LIFE+ programme has the most important synergistic effects with rural development policy and the agri-environment measure in particular. It supports, under its nature and biodiversity headline, conservation projects aiming to create collaborative platforms that enhance partnerships in protected areas, and demonstration projects for biodiversity-friendly agriculture. The scale of LIFE+ funding from the EU budget in the period 2007–2013 for the component dedicated to land management and biodiversity is €0.85 billion (Kettunen *et al,* 2011), in comparison with the total of €22.8 billion dedicated to the agri-environment measure under the rural development policy 2007-2013. In the previous LIFE programme, more than 45 projects directly targeted grasslands, and financed the development of management plans, habitat surveys and mapping, design and the adoption of environmental management in agricultural areas, including conservation actions needed to restore traditional grazing, monitoring, awareness-raising, and networking amongst farmers and rural organisations (European Commission, 2008b). A range of projects also helped to develop agricultural techniques and methods that reduce the external impacts of agriculture on biodiversity through, for example the reduction of run-off and soil erosion and pesticide-related water pollution (European Commission, 2011g). Box 25 provides examples of LIFE+ projects delivering synergistic effects with rural development measures in semi-natural habitats.

Box 25: Examples of LIFE and LIFE+ projects delivering biodiversity benefits on agricultural land

LIFE and LIFE+ projects to enhance the co-existence of farming with large carnivores.
A number of projects have demonstrated the viability of co-habitation of large carnivores with human activities. For example, projects in **Romania, Greece, Croatia, France and Italy**, plus the LIFE COEX project in 5 **Mediterranean** countries, have enabled National Park administrations, local organisations, and farmers to find new ways to manage the co-existence of wolves and bears with farming and eco-tourism. As a result, the Iberian, Alpine and Apennine wolf populations, and the Romanian bear population, have maintained or improved their conservation status and poaching has been substantially reduced. The projects have also improved the viability of traditional agricultural practices such as extensive livestock grazing, fruit orchards, and beekeeping (European Commission, 2011f).

LIFE and LIFE+ projects to restore natural and semi-natural habitats.
Many projects have helped restore natural and semi-natural habitats through support for the reintroduction of traditional extensive agricultural management and through piloting or revising agri-environment schemes. For example, the BurrenLIFE Project in **Ireland** is restoring extensive grazing and scrub management on 47,000ha of limestone pavement, grasslands, and freshwater habitats that have been degraded through a mix of under grazing and intensified grazing practices (European Commission, 2010h). The project involves research and advisory services, marketing initiatives, co-operative structures and the revision of existing agri-environmental schemes. Sweden combined a LIFE project with **Swedish** agri-environment support to restore grazing and meadow management for conservation on 4,500 ha of wetlands and coastal meadows (European Commission, 2008b; European Commission, 2008c; European Commission, 2010e).

LIFE and LIFE+ projects for traditional permanent crops and for extensively grazed grasslands involving conservation of local breeds
The LIFE programme co-financed projects in **Italy, Greece and France** to establish environmental best practices for olive growing and improve co-ordination with agri-environmental measures which resulted in restoration of traditionally cultivated olive groves A LIFE project in **Hungary,** partnered with a local environmental association, farmers and National Park authorities, supported restoration of the Puszta steppe habitat through the reintroduction of extensive grazing using local livestock breeds Monitoring showed the positive impact on breeding bird populations, including several endangered species. New jobs were created for the farming community and awareness was raised regarding the cost-effectiveness of this agricultural management. The **Latvian** Fund for Nature has partnered under a LIFE project with 22 other organisations and 19 municipalities to coordinate a nationwide programme for the restoration and long-term management of some 2,400 ha of floodplain grasslands, including grazing with local breeds of horses and cattle. Management contracts with the farmers are signed on condition that they will apply for funding under agri-environment schemes for at least five years after the end of the LIFE project (European Commission, 2008b; European Commission, 2008c; European Commission, 2010d).

3.7 Effectiveness of other national, voluntary, and market based measures for delivery of biodiversity

There are various Member State initiatives operating at the national, regional and local level that are used to deliver biodiversity benefits through agriculture but which it is not possible to cover within the scope of the study. Examples of voluntary initiatives focussed on promoting farmland biodiversity are set out in Box 26. Only a few market based instruments have a particular focus on the delivery of biodiversity benefits, with green taxes[32] and habitat banking[33] being two examples. None of them have however been explored in further detail in this report because there is little experience on the ground with these measures as yet (Shine, 2005; Eftec and IEEP, 2010).

Box 26: Examples of voluntary initiatives and market based measures with a biodiversity focus

The **Fundatia ADEPT** voluntary rural development initiative in **Taŗnava Mare, Romania**, is an NGO-led project that promotes and pilots delivery of agri-environment schemes. By working closely with local farmers and the government, it encourages large scale uptake of the agri-environment management to maintain extensive area of non-alpine hay meadows in Europe with abundance of wild plants, invertebrates and birds, as well as very rare lowland populations of large carnivores. Promoting of local participation in biodiversity management has involved production of detailed guidelines for traditional management, addressing common problems experienced by farmers in conversion to agri-environment management, and provision of financial top-ups to incentivise the adoption of agri-environment practices. In addition, the project is engaged in developing value-adding processes (for example micro-processing units for milk) and establishing local product branding. The rate of agri-environment uptake in Tarnava Mare has improved and is several times higher than the average in neighbouring areas (Fundatia ADEPT, 2009; Beaufoy and Marsden, 2010).

The UK industry-led initiative launched in 2009, **Campaign for the Farmed Environment**, is supported by the UK government and its environmental agencies. It encourages farmers to carry out specific land management actions by encouraging uptake of existing agri-environment schemes, particularly in highly productive cropped areas, whilst offering no additional payment and requiring no legally binding commitment.

The **LU' harmony project** is a market based measure in **France** requiring producers to cover a minimum of three per cent of their wheat plots with melliferous plants (ie pollinator fallow). In addition national initiatives such as **'Environmental Leasing Contracts'** newly introduced in the French law, allow a landowner to include environmental prescriptions, which the tenant will have to comply with, in the leasing contract. So far, this tool has been used only by public or semi-public bodies.

In **Baden-Württemberg** , an example of a regional non-market based approach is **PLENUM** (Projekt des Landes zur Erhaltung und Entwicklung von Natur und Umwelt), a bottom-up project aimed at creating jobs while safeguarding nature conservation through the promotion of regional processes and markets. Another interesting and novel approach in Baden-Württemberg is the Meadows Championship (Wiesenwettbewerb) a joint project of the local farmers' association, the nature conservation organisation (NABU) and other actors which aims to promote meadow conservation by rewarding the most species rich meadows and biologically diverse holdings.

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[32] Green taxes have been identified as fiscal measures seeking to make the economic costs of biodiversity loss and ecosystem degradation to be felt to by those who cause economic pressures arising from externalities of business, such as pollution and reduction in public benefits from the privately sourced goods from natural and semi-natural areas (TEEB, 2011).

[33] The objective of habitat banking schemes is to generate credits that can be purchased ex ante for planned projects and can be used to compensate ex-post for accidental damage to biodiversity, such as pollution incidents under the Environmental Liability Directive. So far habitat banking has been advocated mostly for use in infrastructure projects (Eftec and IEEP, 2010).

4 FACTORS OF SUCCESS AND FAILURE

This section explores the factors that influence the success and failure of existing CAP instruments with respect to delivering biodiversity benefits.

It is clear that, despite some notable successes, particularly in relation to specific species and habitats in specific locations as well as maintaining extensive farming systems in many areas, the way in which the current suite of policy measures are designed and implemented in Member States is insufficient to meet the EU's biodiversity objectives associated with agriculture. Evidence from the literature and the case studies undertaken as part of this study indicate a wide range of reasons as to why this is the case. These can be broadly categorised as follows:

- Measure and scheme design at the Member State level;
- Farmer attitudes and the role of advice and training;
- Institutional and political factors;
- Implementation of related policies; and
- Other intervening factors outside the control of the farmer or policy.

In practice, it is usually a combination of these factors that contribute to the relative success or failure of a particular policy measure in delivering the desired outcomes for biodiversity. Much of the evidence on the factors of success and failure is focussed on the agri-environment measure and emanates from northern Member States in the EU-15. However, wherever possible, evidence has been gathered for a range of policy instruments and covering the EU-27 to provide as full an overview as possible.

4.1 Measure and Scheme Design at Member State level

One of the most fundamental issues affecting the outcomes of policy measures for biodiversity is their overall design, structure, content and subsequent implementation.

As stated previously, biodiversity is a broad term that encompasses the full spectrum of ecosystems and living organisms. Determining the precise ecological requirements for different habitats and species and how these might be integrated with agricultural management, therefore, is not straightforward. This is made more difficult by the fact that these factors are dynamic and vary spatially and temporally depending on a range of factors, including soil type, climate, weather patterns, whether or not species are migratory or not, etc.

Therefore, the design of policy measures and schemes, the choice of options, the targeting of those options, the payment rates associated with them and the advice provided are all crucial for effective and efficient delivery of outcomes. Effective tailoring and targeting needs to be based on a range of scientific evidence, pilot projects and, best practice understanding from a range of disciplines. While general lessons can be drawn from the evidence, however, its application to the design and implementation of policy measures needs to reflect the biogeographic, climatic, socio-economic and institutional situations of the region concerned. Given the combination of different types of management that may be needed to achieve specific biodiversity outcomes and the location specific nature of the management required, it is not always possible to design the perfect measures from the outset. The design, tailoring and targeting of management actions, therefore, needs to be kept under review to ensure that management options and their targeting can be improved and made more effective over time.

4.1.1 Developing a coherent mix of policy measures

The design and structure of both voluntary incentive schemes and mandatory requirements, such as those required under GAEC standards will need to vary according to the nature of the biodiversity objective being pursued. For example measures to ensure the maintenance of an existing habitat will require a different approach to those required to restore or recreate a particular habitat. Where objectives are clearly articulated, generally appropriate management options can be identified to address these objectives which makes it much easier to translate into effective implementation on the ground. Examples of where this has happened can be seen in the use of the agri-environment measures to develop schemes in specific locations for particular species, for example the Little Bustard (*Tetrax tetrax*) (France), the common hamster (*Cricetus cricetus*) in the Netherlands and Germany or the Corncrake (*Crex* crex) in Scotland (UK) (see for example RSPB and BirdLife International, 2011). However, in practice, one of the issues that is commonly raised is that there is insufficient clarity within policy measures on what the biodiversity priorities are in relation to agriculture (Polman and Slangen, 2007; Dwyer *et al,* 2008a; Dwyer *et al*, 2008b; European Court of Auditors, 2011b). This was highlighted as a concern in the case studies in France and the Czech Republic.

Being clear about the objectives to be achieved is critical in order to be able to design policy responses that include not only the optimal mix and design of policy measures to address the issues and the correct mix of management actions in the menu of options on offer to farmers, but also ensure coherence between different measures, particularly in relation to their eligibility criteria and management requirements. The evidence set out in Chapter 3 suggests that the focus has tended in many regions to be on the design of policy measures in isolation to achieve the desired outcome rather than considering the interactions between different policy instruments. Rather than delivering added value by creating a suite of policy instruments that work synergistically, this has the potential to lead to unintended conflicts between policy measures which in some cases has compromised the delivery of biodiversity. One example of such a conflict arising relates to the eligibility criteria for farmland to receive Pillar 1 direct payments, as elaborated in Chapter 3. Another example concerns the relationship between regulatory or cross-compliance requirements and the operation of the land management measures available through Pillar 2. These should provide the foundation for more demanding Pillar 2 measures. However, in practice more active linkages could be made to ensure that the design of agri-environment measures builds on the management required under GAEC, for example through using agri-environment schemes to introduce wider field margins that those required under cross compliance. In some cases there are even examples of conflicting management requirements, which could be avoided if the design of all policy measures were to take place in a more coordinated way.

An important issue for the success of measures focussed on biodiversity is to ensure that the right package or combination of support is available to farmers. Particularly in economically lagging or otherwise marginal regions across Europe, the management of semi-natural habitats and maintenance of HNV farming systems requires a combination of measures to address social and economic needs (for example capital investments, access to markets, diversification, extension services, information, advisory services and training) alongside agri-environment schemes to provide support for the environmental management of the land. These sorts of complementary measures are seen as essential for creating an enabling environment both for continuation and sustainable development of farming systems and for biodiversity (Beaufoy and Marsden, 2010; Cumulus Consultants, 2011)**.** In practice however, the availability of these 'packages' of measures is often insufficient or missing from rural development programmes. Using measures in combination or in a complementary manner is not just important in more marginal areas, however. Habitat restoration, for example wetland restoration, often also requires a mix of capital investment and support for appropriate land management, benefitting from funding available from a number of measures available in all axes of the current rural development policy.

The degree of flexibility permitted within a particular scheme or measure is also relevant. Farmers tend to respond more positively to scheme prescriptions that are flexible and allow them to adjust management to the particular conditions on their land (Gorton *et al,* 2008). By contrast the imposition of controls and rules with no flexibility, particularly when they do not make sense in particular local circumstances, can have the opposite effect. While lack of flexibility may not always prevent entry into schemes promoting biodiversity, it can influence attitudes towards, and experience of, schemes and may therefore influence the success of the outcomes achieved and the likelihood of longer term engagement with environmental management. Especially in Member States where there has been a long experience with agri-environment schemes, there is increasing evidence of farmers wanting to have a say in designing the prescriptions for delivering the desired outcomes and of this leading to successful outcomes (see Box 27). However, scheme flexibility does not come without its risks. An evaluation of the Entry Level Stewardship agri-environment scheme in England (UK), which allows farmers to freely choose which combination of management to undertake on their holding, found that farmers tended to choose options that involved relatively little change and incur limited costs, most likely bringing about few environmental gains (Hodge and Reader, 2010).

Box 27: Examples of collaborative approaches to scheme design

Wales (UK): Farmers in the self-initiated Pontbren partnership in Wales were reluctant to participate in the formal Welsh agri-environment scheme because of its inflexibility at local level. Instead they created their own initiative which was flexible and better suited to their farms (Posthumus and Morris, 2010).

Netherlands: A co-operative 'landscape-scale' approach to delivering agri-environment schemes has been developed whereby 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. First introduced in 1992, there are now over 100 cooperatives in existence and in 2004 these included 10 per cent of all farmers and 40 per cent of agricultural land (Cooper *et al,* 2009).

An additional detailed, but important point for scheme design is to ensure consistency in scheme prescriptions. An example from the French case study illustrates issues that can occur if conflicts arise. Here, a specific agri-environment option has been designed within the agri-environment scheme focussed on biodiversity in Natura 2000 areas, whose aim is to maintain the management of grasslands and rough grazing in order to protect herbaceous strata and scrub characteristic of this type of habitats (HERBE-09). However, in order to be eligible for this option, farmers must me*et* all the criteria of the basic grassland scheme and this requires all scrub to be removed for farmers to be eligible. Because of this confusion, there is evidence to show that this has acted as a disincentive for a number of farmers to take up these management options for fear of controls (De Sainte Marie *et al,* 2010).

4.1.2 Targeting and tailoring

Improvements in the tailoring and targeting of schemes and management options is often highlighted as a key means of improving the nature of biodiversity outcomes achieved (Evans *et al,* 2002; Schmitzberger *et al,* 2005; Butler *et al,* 2009; Merckx *et al,* 2009; Perkins *et al,* 2011; Winspear *et al,* 2010). This is unsurprising as management options provide minimal benefit if they are not adopted in the areas where they are most needed in order to address the environmental issues identified. The scientific literature demonstrates that in general it is ensuring that the right sorts of measures, in the right combination and in the right location that is important for the delivery of different aspects of biodiversity (Vickery *et al,* 2008; Wilson *et al,* 2009; Winspear *et al,* 2010). This requires tailoring management prescriptions to the particular habitat/species and often in relation to the particular site as well as targeting interventions to areas/locations where the management is most likely to have an impact.

However, the degree of specificity needed in targeting particular measures and management actions varies according to the biodiversity objective being pursued. Tailored management delivered through a targeted approach is essential where specific environmental management is required in particular locations. For example, research undertaken on the needs of farmland biodiversity highlights the importance of targeted and specifically designed management to achieve the specific ecological requirements for the particular habitats or species in question, even where this relates to common rather than specialist farmland species (Evans *et al,* 2002; Butler *et al,* 2009; Perkins *et al,* 2011). Examples include the conservation of scarce species, such as the Corn Bunting (*Miliaria calandra*) in the UK (Perkins *et al,* 2011), the restoration of specific habitats, for example peatlands. This is not straightforward. It requires not only detailed ecological knowledge of the needs of different species and habitats, but also considerable flexibility in terms of delivery to allow management to be adjusted according to local circumstances and even weather conditions.

Such detailed targeting will not be necessary in all circumstances. For example, where the priority is to maintain current areas of HNV farmland, then it may simply be necessary to stipulate the continuation of existing management practices, grazing patterns, input use, and so on. Indeed, allowing variations in management at the field scale can be beneficial for biodiversity in semi-natural habitats, by avoiding the homogenisation and standardisation of management in the farmed landscape that can be the result of standard prescriptions. Nonetheless, ensuring that schemes and measures are tailored appropriately in relation to the nature of the biodiversity objectives identified is critical.

Another issue arising in relation to targeting is the balance in the types of farm and agricultural habitats that form the focus of schemes. In the past agri-environment schemes have tended to focus on maintaining extensive grazing to protect semi-natural habitats alongside promoting genetic diversity and organic farming practices, as well as focussing on improving the conservation status of rare species. More recently, however schemes increasingly focus on enhancing biodiversity within improved habitats as well, particularly arable and intensive livestock systems. Evidence from the case studies indicates that the balance of funds between these different types of habitats is not always optimal for achieving maximum impact on biodiversity and this is highlighted as an area for improvement.

The scale at which biodiversity management is carried out is an important factor of success. In general, CAP measures are delivered at the individual holding scale currently. However, the delivery of many environmental objectives, including biodiversity, could be improved significantly if management could be assured over a much larger area, for example involving multiple farm holdings working collaboratively within a coherent geographic area (Franks and Mc Gloin, 2006; Merckx *et al,* 2009; ENRD, 2010; Pražan *et al,* 2010; Hart *et al,* 2011b). Encouraging the uptake of measures at a landscape scale could help improve policy outcomes in relation to addressing the pressures on biodiversity from climate change (for example through ecosystem-based approaches to mitigation and adaptation), tackling habitat fragmentation, as well as maintaining High Nature Value Farming systems.

Landscape scale approaches are already in place in some Member States. For example, evidence from the case studies shows that, in the Czech Republic, all types of landscape features created through the process of land consolidation are subject first to careful landscape assessment by the project manager. Although the main priority influencing their placement is to reduce water run off and erosion, at the same time they play a significant role in supporting biodiversity and creating ecological networks (Pražan and Dumbrovský 2010). In England (UK), a per hectare supplement is available to applicants of the Higher Level Stewardship agri-environment scheme for group applications. This payment contributes towards the costs of facilitating linked agreements. It is particularly targeted at common land and areas of shared grazing, but may also be applied to agreements covering areas under multiple ownership, for example related to inter-tidal habitat management and/or wetland management (Natural England, 2010c). Despite the availability of these supplements, however, the England case study suggests that beyond the management of common land, farmers are often reluctant to enter into coordinated or collaborative agreements either for environmental purposes or for other reasons, and highlights this as an issue which needs to be addressed in order to achieve better delivery of biodiversity and wider environmental priorities at the landscape scale.

4.1.3 Accessibility and attractiveness of schemes

Building on the points raised above in relation to the importance of flexibility in policy design and the need for policy measures to reflect the variability of conditions on individual farms, evidence shows that schemes are less likely to achieve their objectives if they are overly complex, particularly if this complexity is not necessary to deliver the desired biodiversity benefits, is not practical from an agronomic perspective or has unnecessarily adverse impacts on farm viability in the longer term (see for example Pražan and Dumbrovský, 2010).

In many situations different types of management could be implemented to deliver the biodiversity outcomes required. For example, in the case of arable farmland birds, spring-summer invertebrate food could be provided through various forms of management including the introduction or maintenance of conservation headlands, low-input spring cereals, undersown spring cereals, uncropped cultivated margins, nectar flower mixtures, field corners, beetle banks or flower-rich margins. The choice of which management is most appropriate will depend, not only on the geographic and biophysical characteristics of the area in which they are needed, but also on which fit best with the operation of the farm, and for this reason some types of management will be more popular with farmers than others (Hart *et al,* 2011a). In some places, in order to increase the attractiveness of biodiversity management to farmers, attempts are being made to develop new management options that would provide the same environmental benefits but impinge on productive operations less, for example providing seed for birds in winter by planting seed crops that are not harvested but left solely as a bird food resource as an alternative to options that require reductions in herbicide use and the maintenance of over-winter stubble.

The Czech case study highlighted a separate issue in relation to the attractiveness of different types of management related to their time and labour intensity and the impacts on lifestyle. For example, there is a lack of interest amongst the majority of farmers to cut grass by scythe or using light machinery, particularly in wet areas due to these factors. This is exacerbated by the fact that, often farmers manage large areas of land but these are spread over many farms, often with significant distances between them. In these situations, where management that requires very specific activities at a particular time of year, it may be problematic for farmers to undertake all the necessary management in time (Pražan, 2011).

In relation to cross-compliance requirements, an evaluation of cross-compliance in England found that cross-compliance had led to increased awareness of some environmental issues related to agriculture, particularly in relation to soils (ADAS, 2009). It had also stimulated some farms to seek to understand pre-existing legislative and GAEC requirements. However, some cross-compliance standards also led to confusion and were considered too vague or complex and lacking in clarity. As a result they were viewed as an unnecessary burden or hurdle with which they needed to comply. In particular, there was uncertainty concerning how rules would be interpreted by inspectors, which created anxiety and hence antagonism towards the whole cross-compliance framework.

4.1.4 Payment Rates

Where policy measures provide payments to farmers to undertake biodiversity management, the attractiveness of payment rates can have a significant impact on uptake of the relevant management required.

This is particularly the case in relation to more productive land, where the payments are often not perceived as sufficient to outweigh the opportunity cost of undertaking the management required and being tied into an agreement for at least five years, particularly at times of high commodity prices. In these situations, the payment rate offered is often insufficient to induce such a change, particularly when the contractual arrangements mean that their flexibility to react to future changes is constrained over a period of time. However, in these situations, much of this perceived lack of flexibility relates to the restrictions that a multi-year agreement would place on farmers' abilities to respond to and capitalise on changing market changes and prices for goods and services rather than the size of the payment itself. Developing management options that have minimal impact on the productive capacity of land managers and yet still deliver the environmental benefits required, such as those described in the section above, would therefore be likely to increase uptake (Hart *et al,* 2011a).

There were mixed findings from the case studies as to whether or not payment rates had a significant impact on scheme uptake. The German case study highlighted the fact that the formula for calculating payments for agri-environment schemes, which limits payments to income foregone and additional costs, the incentive element having been withdrawn in 2007 for WTO compatibility reasons, has reduced the attractiveness of the MEKA III agri-environment measures. Experts in Germany have highlighted the importance of an additional incentive or 'carrot' to motivate farmers to undertake these measures, especially biodiversity related measures, which may be more complex in nature (MEPL II midterm review, 2010). This issue was also highlighted in the UK case study, which commented that payment rates overlook the wider 'hassle factor' of entering into an agri-environment scheme agreement, as the general disturbance to 'normal' farming practices is not accounted for in the payment rate, given that it is hard to quantify the cost of such disruption. This perception persists despite the fact that the rural development regulation permits Member States to include an element of 'transaction costs' within the payment calculations.

Payment rates also play a role in the uptake of management options in extensive systems. However, here the issue is more that farmers are often unconvinced of the opportunities offered by agri-environment contacts to continue extensive farming practices, as well as the longevity of the societal commitment to support these assets. For example, the opportunity cost (and therefore payment offered) of continuing farming may be equal to the cessation of farming practice and uptake of other employment (Redman, 2010). A recent study in

Spain, looking at alternative policy options for the Spanish High Nature Value cereal-steppe systems showed that payments under an agri-environment measure that has been specifically designed for conserving local cereal-steppe birds in a protected area are sufficient to avoid the abandonment of management and could therefore play an important role in maintaining and enhancing the farmed habitat for birds (Oñate *et al,* 2007). In this kind of situation, the role of advice and scheme promotion is particularly important to encourage farmers to stay in farming rather than abandon their land (see below).

4.1.5 Ongoing evaluation and review

Experience from Member States in which biodiversity measures have been in place for many years show that it is not always possible to design the perfect measures from the outset to achieve the biodiversity outcomes required (Burrell, 2011). Management which was effective under experimental conditions or as part of a pilot study does not always have the same results when implemented on the farm, or can lead to unanticipated adverse effects (Kleijn *et al,* 2001; Ohl *et al,* 2008). In addition, some outcomes can take many years for impacts to become evident.

Effective monitoring and evaluation is critical to assess the effectiveness and efficiency of measures in delivering their objectives and to allow schemes and management practices to be adapted and refined over time. Evidence from the case studies demonstrates that where this happens, schemes become more successful at delivering their objectives over time. For example in England (UK), an official review of agri-environment schemes in 2002 – 2004 led to the development, piloting and implementation of a completely new scheme in 2005 (Environmental Stewardship (ES)) that built on the successful elements of the two previous schemes. ES was subsequently reviewed in 2008 to monitor its effectiveness in meeting environmental targets (Natural England, 2009). This in turn has led to changes in targeting, management options made available to farmers, the way in which the scheme is delivered as well as improvements to advice and training programmes.

However, this process of scheme review does not take place consistently in all parts of the EU. Indeed, the Greek case study highlighted the absence of incorporating monitoring findings back into scheme (re)design as a significant limiting factor on improving scheme design over time. In the Czech Republic too, the emphasis in monitoring on measuring uptake rather than the impacts of schemes also was highlighted as limiting the availability of information on which scheme improvements could be made.

4.2 Farmer Attitudes and the Role of Advice and Training

Advice and information provision alongside training and skills development have been shown to be a key factor influencing the successful implementation of policy measures to deliver biodiversity outcomes in many regions of the EU. This is true for voluntary measures, such as agri-environment schemes, as well as for regulatory requirements and GAEC standards, as required under cross-compliance.

The adequacy of the provision of advice and/or training on biodiversity issues to land managers varies between Member States, in terms of its availability, frequency, costs and accessibility. Although most governments provide support for farmers to obtain advice and up-to-date information about agricultural activities, there is often less advice available on environmental management practices and how these might be integrated into farm management activities. The only common advisory service that provides advice on environmental land management in all 27 Member States is the Farm Advisory Service (FAS). Although its prime focus is to provide advice on the implementation of cross-compliance, it has also been used in a few Member States to provide advice on agri-environment management (ADE, 2009).

Farmer attitudes play an important role in influencing participation in voluntary environmental schemes. In all countries these range from those with a strong resistance to engaging in environmental management to those who strongly believe in the need to integrate environmental management into the farming system (Morris, 2000; Quinn, 2009; Van Dijk *et al,* 2009). Attitudes are formed partly by cultural values, upbringing and education, but can also be influenced by training, better access to information and by interaction and sharing experiences with other land managers. However such cultural values need to be taken into account when considering the nature of advice, training or capacity building needed in any given situation. For example, resistance to engaging with environmental management may result from an aversion to being constrained in terms of management choices, a view that biodiversity is separate to the core business of producing food for the market, or may be based on socio-historical factors associated with differing experiences of environmental integration in the EU-27, and with agri-environment in particular. There may also be differences in the response to voluntary schemes and the degree of flexibility within such schemes in countries historically associated with institutions built on liberal attitudes in comparison with those which have experienced institutions built on hierarchically transmitted and received norms. Factors of legal history play a role too, leading to differing perceptions in the EU-15 and EU-12 of the opportunity they have for self-determination and the level of perceived dependence on external factors including markets, prices, seed and fertiliser provision, and governmental decisions (Hart *et al,* 2011b).

In countries where research has been carried out, a positive correlation has been shown between environmental training provided for farmers, including the availability of demonstration farms and the level of understanding and uptake of environmentally beneficial management options through agri-environment schemes, including how to tailor options to local circumstances (Morris, 2000; Kleijn *et al*; 2001; Lobley *et al,* 2011). Evidence from many northern European countries indicates that the greater the understanding of the benefits of environmental measures and the outcomes expected, the more likely a land manager is to commit to undertaking such management and the more likely the outcomes are to be successful and sustained in the longer term (Morris, 2000; Herzon and Mikk, 2007). The link between the availability of training and uptake of agri-environment schemes is also evident within new Member States. For example the difference in uptake in Estonia and Poland was reviewed shortly after their accession to the EU. This showed that in some new Member States, such as Estonia, farmers had a favourable attitude to agri-environment which had been encouraged and supported by compulsory agri-environment training for those entering agri-environment schemes. In contrast, in Poland, farmer training did not cover agri-environment management, and advisers lacked environmental skills which contributed to a low uptake of agri-environment schemes (Keenleyside *et al,* 2006).

Continued engagement and support for farmers after they enter schemes through the provision of good quality and consistent advice is often highlighted as particularly important to enhance learning and increased awareness. Indeed, encouraging an ongoing culture of learning is likely to facilitate more willingness to change behaviour (Dwyer *et al,* 2007). Face to face advice with farm advisers is a critical element of this and advisers are frequently mentioned as significant intermediary actors between farmers and policy (Drake *et al,* 1999; Weis *et al,* 2000; Deffuant 2001; Juntti and Potter, 2002; Fish *et al,* 2003; ADAS, 2004; Morris, 2006; Wales Audit Office, 2007).

Despite this, however, it seems that there remains a lack of understanding of the reasons why certain management is required to achieve biodiversity outcomes amongst a significant number of farmers (Morris, 2006; Burton *et al,* 2008). One of the reasons put forward for why this may be the case relates to the prescription led approach of policy measures, whereby farmers are required to follow a set of 'rules' in the form of specific management prescriptions rather than being given the flexibility to use their own knowledge and experience to determine how best to deliver the biodiversity (or other environmental) outcomes required.

Research in Germany and Scotland (UK) concluded that prescription led approaches were felt to 'de-skill' farming, in the sense that farmers felt they were unable to display their management competencies through easily identifiable outputs, such as yields. This in turn meant that they did not feel pride in their conservation achievements. Changes in the way that agri-environment management options are designed and presented to farmers, coupled with training could facilitate a change in outlook and provide farmers with a sense of the value of their environmental achievements (Burton *et al,* 2008).

Linked to this is the importance of demonstrating the positive impacts of policy measures to increase the motivation of farmers to continue with the management required to deliver biodiversity outcomes. This is a message that emerges from evaluations in the UK and Germany, where farmers emphasised the importance of feedback and recognition for what had been achieved over their time in the scheme (Oppermann, 2003; ADAS, 2004; Wales Audit Office, 2007; Ingram *et al,* 2009). This is particularly important when benefits are not necessarily observable to the non-expert, so that farmers can see that their management and participation in schemes is making a difference (Dwyer *et al,* 2007). In practice there are different ways of achieving this and not all approaches will be appropriate necessarily to all situations in the EU-27. For example, in Baden-Württemberg (Germany) there has been some success in developing a self-evaluation system of ecological performance whereby farmers are involved in assessing the biodiversity impacts on their own farms (Oppermann, 2003). Linked to this, it has been found that more demanding conservation-oriented agri-environment schemes may work better if linked explicitly to the support of specific species, which farmers themselves know well and feel positive about, rather than to an abstract concept such as 'biodiversity' which they do not understand (Herzon and Mikk, 2007). This is also highlighted in the Czech case study, where the concept of 'landscape' is much better understood that that of 'biodiversity' and therefore couching scheme objectives in these terms is much more likely to lead to engagement in the scheme and uptake of the relevant management by farmers.

Sharing information and experiences between farmers can also improve the delivery of biodiversity outcomes on the ground. Indeed, the significance of farmer groups in supporting each other in new enterprises and initiatives including environmental projects has been noted in a range of studies (Garforth, 2003; Dwyer *et al,* 2007; Posthumus and Morris, 2010). The importance of support and advice from trusted peers was highlighted in the England (UK) case study in particular. This stressed that 'ambassadors' within local communities, or local farming groups are often trusted more and better respected than scheme advisors or officials and that farmers may take the advice that they provide more seriously and give it greater consideration.

There are a range of different motivations amongst farmers for undertaking environmental management on their holdings, many of which have been addressed in the sections above. However, uptake of voluntary schemes, such as agri-environment, is also influenced by attitudes towards the environment. In northern Member States in particular, considerable research effort has been put into considering the links between attitude towards the environment, motivation and agri-environment scheme participation, looking at the degree to which engagement with environmental management leads to long-term behavioural change in terms of a greater understanding of, and concern for, biodiversity among those who benefit from the policy.

For a proportion of farmers, the evidence suggests that there is limited engagement in biodiversity issues and little positive attitudinal change as a result of engagement in agri-environment schemes (Burton *et al,* 2008). However, this looks as if it may be changing and that attitudes towards the environment are becoming more positive among farmers participating in agri-environment schemes. Nonetheless, many farmers are motivated to participate in schemes by a combination of compatibility of management with the existing farming system and the level of payment rates on offer (see above) (Morris and Potter, 1995; Harrison *et al,* 1998; Lobley and Potter, 1998; Wilson and Hart, 2000, 2001; Schmitzberger *et al,* 2005; Schenk *et al,* 2007; Defrancesco *et al,* 2008). Measures of participation in schemes can therefore mask levels of actual commitment, intended long-term behavioural change and therefore the potential sustainability of actions undertaken in the longer term. Research suggests that farmers who enter schemes solely based on financial motivation are less likely to change their behaviour long-term and will be more likely leave a scheme if rewards (such as increased commodity prices) can be gained elsewhere (see for example Tranter *et al,* 2007). A recent study in the Netherlands showed that only the combination of feedback to the farmer about progress made in delivering agri-environment objectives linked to the making of a public commitment to deliver such changes was effective in eliciting behavioural change (Lokhorst *et al,* 2010; 2011). The introduction of agri-environment schemes that cover large areas of the farmed landscape, however, is believed to be another factor that can lead to more positive attitudes towards the environment and environmental schemes by farmers, leading to a greater chance of sustaining behavioural change (Hodge and Reader, 2007; Manley and Smith, 2007; Ingram *et al,* 2009; Van Rensburg *et al,* 2009).

Box 28: Examples of advice provision in case study countries

Czech Republic: The system of advice provision in the Czech Republic is under review. However, currently (2011) general advice is provided by private advisors, research institutes, universities, and agents selling inputs to farmers. More specialist advice relating to the implementation of policy measures is provided by private advisers, supervised by state advisors, usually one per region which is felt to be insufficient. All staff administering CAP policies that relate to biodiversity are regularly trained by Ministry of Agriculture (MoA) staff.

Advice on the agri-environment measure is available on the MoA and Paying Agency website, and also in printed form in regional offices of the MoA. In terms of face to face advice, outside protected areas farmers are only provided with limited assistance, such as help with the preparation of application forms, due to the lack of capacity within the regional MoA offices (Pražan, 2011). Within protected areas, however, more advice is provided, although this is not without its problems. Despite schemes being tailored to the local needs, advice tends to focus on the environmental priorities without consideration of the agronomic impacts that achieving these objectives may have. Farmers experience problems with dealing with the decision makers and negotiating with administration within protected areas, which leads to certain groups of farmers (eg small farms or less assertive or older farmers) agreeing to restrictions on their management that make it difficult to maintain farm viability and that ultimately leads to a decrease in trust in the policy and administration and reduces future willingness to participate in the scheme (Pražan 2011). From the administrators' perspective, they feel that there are insufficient numbers of staff to build trust between themselves and farmers and to assist them fully with agri-environment schemes (UZEI, 2011).

UK (England): The original design of the Entry Level Stewardship agri-environment scheme in England was as a 'hands off' scheme which allowed allows farmers a free choice of which management options to carry out and support in making these choices was limited to the availability of the scheme handbook (available online and in printed form). This approach was favoured by farmers and helped keep scheme overheads low. However in practice, reviews of the scheme (CSL and CCRI, 2008; Natural England 2009a) showed that option uptake was biased towards those options that had less of an impact on the productive land. Therefore, while ELS had been effective in bringing field boundary features into agreement, there had been a comparatively low uptake of the in-field options, which are critical for certain aspects of biodiversity, particularly arable farmland birds. As a result, steps are being taken to improve the uptake of these options through increased provision of advice through Natural England's ELS Training and Improvement Programme (ETIP). ETIP offers free workshops, one-to-one farm visits, farm walks and other events run either by Natural England advisors or external contractors. As of March 2011, 1600 farmers were foreseen to have been supported under the programme (Natural England, 2010a). It is too early to see the effect of the ETIP on option choice, but this is being kept under review.

4.3 Institutional Factors

Institutional factors have an important role to play in assuring the effective and efficient delivery of biodiversity outcomes through the operation of different policy measures. Having the appropriate administrative and technical resources and expertise in place, including appropriately trained staff who understand the dynamic interactions between agriculture and the environment, adequate databases, and suitable systems in order to be able to target and monitor measures well, to deliver payments efficiently and to ensure effective control and enforcement are all factors critical to help maximise the successful design and implementation of policy measures in practice (ENRD, 2010; Hart *et al,* 2011a).

Particularly in some of the New Member States, a lack of experience in policy making and policy design and delivery leads to schemes that are not as effective as they could be. This is highlighted in the Czech case study, which highlights that lack of experience can lead to the establishment of vague objectives, often defined in output terms (in hectares under management) rather than impact (Ministerstvo zemědělství 2008, interviews with government officials).

The availability of data and the technical resources needed to enable the targeting of measures and their subsequent monitoring and evaluation is a key factor that impacts on the success of biodiversity policy measures. The degree to which the data and relevant systems are available is variable in different Member States. However, in many regions, good data are available but not necessarily accessible, compatible or available in a format that is usable for the purposes required. For example many of the New Member States have a wealth of data on land use, land capability, and more recently have carried out detailed surveys on semi-natural habitats. In some cases this very detailed information has been made available publically via the Land Parcel Information System (LPIS). In many situations, however, the costs of bringing the various data sources together, making them compatible and accessible are high and this sort of investment is therefore not always seen as a priority. This seriously limits the ability to design effective measures for biodiversity where targeting is important, but also limits the ability to monitor, evaluate and review scheme performance in order to improve delivery in the future.

Working in partnership and facilitating good interaction between the public sector, farming organisations, agronomists, farm advisers, environmental interests and research bodies is also an important way of making the delivery of policy measures more effective. Good consultation with relevant stakeholders is an important part of measure design as well as their subsequent review and revision and collaboration of this sort can lead to new approaches and solutions being found to deliver outcomes and make the delivery of schemes more effective. The need for effective and open communication is not just important between government and stakeholders, but within government itself, particularly in the case of biodiversity between the government departments responsible for agriculture and those responsible for the environment, where these are separate.

The relationship and level of interaction between these different actors can have a significant impact on the way in which environmental schemes are delivered and the outcomes achieved. This is evidenced in the case studies as well as a recent survey of practices in different Member States which showed that 'in both Finland and Estonia, the high level of cooperation has resulted in improved implementation, … better agreement on objectives and more transparent objectives and use of funds'. In contrast, conflict and lack of communication were perceived to have reduced the effectiveness of environmental measures in Slovakia and Greece (ENRD, 2010). The process of policy design and implementation can influence the nature of farmers' engagement as much as the final design of the policy measures. Involving farmers or their representative bodies in the design of a particular policy measure can affect the eventual acceptance of the schemes or measures by farmers and potentially the outcomes achieved. Although communication and liaison with the relevant social, economic and environmental partners is required under the EAFRD[34], the degree to which consultation takes place in a meaningful way varies in different Member States.

An interesting example of the value of effective consultation relates to the implementation of the Habitats Directive in Finland, the designation of the Natura 2000 network and the environmental management required as a result. A number of commentators suggest that farmers felt that they were not properly informed about the programme and its consequences. They felt that their own views were not listened to, and that the areas to be protected were chosen in an arbitrary manner (Oksanen, 2003 cited by Siebert *et al,* 2006). This is reported as having had repercussions in terms of the buy-in by farmers to the conservation of Natura 2000 sites and having led to a lack of trust between farmers and the environmental administration in Finland which is still ongoing (Hiedanpää, 2002; Oksanen, 2003 cited by Siebert *et al,* 2006; Kaljonen 2006).

Lack of political commitment to biodiversity as a policy priority is raised as an issue affecting the success of policy measures in a number of case studies, particularly the Czech Republic and France. This is seen as an underlying factor that influences negatively the degree of attention, effort and allocation of resources (both financial and human) to the development of policy measures in this field. Indeed, based on interviews with public officials, the Czech case study stresses, that although biodiversity is included within all key policy documents and the rhetoric sounds favourable, when it comes to designing the policies and distributing the budgets, in practice it does not feature amongst the issues of highest priority. In particular, there continues to be a tendency for biodiversity protection to be considered chiefly as a barrier for economic growth which acts as a barrier for the design and implementation of the policies for biodiversity, particularly when decisions are being made about the allocation of scarce national funds to co-finance measures. The case study suggests that the reason for the inadequacy in the number of farm advisers in relation to environmental issues results from a combination of the need to save costs on administrative staff with the fact that biodiversity is not viewed as a political priority.

[34] Article 6 of Council Regulation 1698/2005 states that 'The Member State shall designate the most representative partners at national, regional and local level and in the economic, social, environmental or other sphere (hereinafter partners). It shall create the conditions for a broad and effective involvement of all appropriate bodies, in accordance with national rules and practices, taking into account the need to promote equality between men and women and sustainable development through integration of environmental protection and improvement requirements'.

4.4 Implementation of other policies

It is important to recognise that policy measures under the CAP do not operate in isolation. They interact with a range of other policies and the requirements stipulated or incentives offered by these. Their effectiveness, therefore, can be affected by both the nature of the requirements in place and the degree to which these are compatible or incompatible with the requirements of biodiversity-focussed CAP measures, as well as the degree to which they are implemented and enforced in practice.

The implementation and operation of the Natura 2000 network is a good example, where poor implementation affects the ability of CAP measures to maximise biodiversity outcomes. Under the requirements of the Habitats Directive, Member States are not only required to set up a network of protected areas but are also required to stipulate the management requirements needed for these areas to bring them into favourable conservation status. The form that these that these management requirements can take can vary, for example they can be stipulated through both management plans or other means (ie legislative requirements). However in many parts of the EU, although Natura 2000 areas have been identified and designated, the management requirements for these sites have not been identified. This means that in many places, it is unclear what management is needed to bring sites into favourable conservation status and risk funds under policy measures, such as the agri-environment measure, being used in an inefficient manner. This issue was highlighted in the Greek case study, where the absence of legally binding Environmental Management Plans for Natura 2000 areas caused significant problems for the design of cross compliance requirements as well as Natura 2000 payments and agri-environment schemes in Pillar 2. This was not helped by the poor communication between the Ministry of the Environment (responsible for the implementation of Natura 2000 legislation) and the Directorate of Environmental Protection and Land Use Planning in the Ministry of Rural Development and Food, who were responsible for the implementation of the agricultural schemes. These issues are thought to be one of the factors that influenced negatively the uptake rate of the Natura 2000 and agri-environment measures in Greece.

The Environmental Impact Assessment Directive[35] in relation to agriculture is another case in point. Under Annex II of the directive, certain agricultural projects may need to be subject to an EIA, subject to national discretion. Projects that are of relevance to biodiversity include: projects for the restructuring of rural land holdings; projects for the use of uncultivated land or semi-natural areas for intensive agricultural purposes; water management projects for agriculture, including irrigation and land drainage projects; and intensive livestock installations. In In terms of practical implementation, however, some stakeholders are of the opinion that Member States have transcribed the Directive into national legislation with a rather light touch. The extent to which the biodiversity value of farmland is taken into account within an EIA depends on the suitability of the screening criteria set as well as the criteria used to assess the potential environmental impacts in any

[35] Council Directive 85/337/EEC (O.J. No. L175, 5.7.85, p.40) on the assessment of the effects of certain public and private projects on the environment, as amended by Council Directive 97/11/EC, Directive 2003/35/EC (O.J. No. L156, 25.6.03, p. 17)

subsequent assessment. In many Member States, the screening criteria are such that very few projects are affected in practice. This has consequences for the effectiveness of the Directive in terms of protecting uncultivated or semi-natural areas of agricultural land. In Natura 2000 areas the implementation of Article 6 of the Habitats Directive in theory provides another means of protecting the ecological integrity of these sites (see Box 29).

Box 29: Issues relating to the implementation of the Habitats Directive and the EIA Directive

Implementation of the Habitats Directive: Recent evaluations show that the **implementation** of measures under the Habitats Directives is slow, of variable quality across the EU, and that the delay in establishing the management actions required for many Natura 2000 sites hampers implementation of CAP policy measures. Of particular concern is that few Member States are implementing measures to improve the connectivity of habitats under Article 10 (IEEP, 2010).

Article 6(3) and 6(4) of the Habitats Directive requires plans and projects that may affect the integrity of a Natura network to be assessed prior to their implementation. Article 6(3) requires that competent authorities undertake **measures for ex-ante assessment** of such plans and projects. Under Article 6(4) **compensation measures** must be taken to protect the coherence of the overall network where damaging projects are allowed to go ahead (because there are imperative reasons of overriding public interest and no alternatives). Some confusion and concerns have been raised concerning the **implementation** of these measures. Environmental organisations have criticised project assessments as being frequently vague and too general in nature, that the concept of 'imperative reasons of overriding concern' required clarification and that compensation measures, where provided, were often inadequate or not targeted to the protected species and habitats that were the subject of impacts. In response the Commission issued guidance on the use of this Article to facilitate implementation in the future (IEEP, 2010).

Implementation of the EIA Directive: Article 3 of the EIA Directive sets out **'screening measures'** for determining whether a project is subject to an environmental impact assessment. Projects, which fall under one of the 23 headings in Annex I, must be made subject to an EIA. Specific agriculture projects, namely projects for restructuring of the rural land holdings; afforestation, pig-rearing and chicken-rearing installations; as well as energy projects belong in the Annex I group. For Annex II projects a Member State must decide, based on a case-by-case examination, and/or by reference to thresholds or criteria, whether an EIA is required or not.

Regarding Annex II measures, a recent report by the European Commission summarised the findings of the European Court of Justice from which it is evident that that Member States often exceed their margin of discretion when establishing thresholds, either by taking account of only some levels of selection criteria in Annex III or by exempting some projects in advance. The report pointed out that the different threshold levels set by the Member States have clear implications for the level of EIA activity in each of the Member States, even of similar size. Furthermore, there were still several cases in which cumulative effects were not taken into account (European Commission, 2009d).

Source: European Commission, 2009d; IEEP, 2010 ; Volkery *et al,* 2011.

Within the CAP itself, there are also examples of how decisions about the implementation of certain aspects of Pillar 1 measures and cross compliance GAEC standards can work counter to biodiversity objectives. These have been set out in Chapter 3 and highlighted in relation to policy design in section 4.1.1.

An example of where objectives of different policies appear to be working counter to one another is evident through the example of incentives for bioenergy feedstock production.

This is highlighted as a particular issue in the German case study where national incentives provided by the Renewable Energy Sources Act (EEG) has distorted competition and has led to regional competition between energy and food production. As a consequence, arable land used for energy maize production has increased significantly and in some regions grassland has been ploughed up for that reason. Payments under agri-environment measures in Germany are unable to compete with the more attractive incentives of the EEG.

These kinds of conflicts and trade-offs may also arise within the measures and schemes funded in RDPs themselves. For example in some regions incentives are made available to promote investment for the installation of anaerobic digesters on farms for the production of renewable energy. Whereas there are a variety of inputs that can be used for anaerobic digestion, including waste products, maize is also commonly used and in practice these investments therefore can contribute indirectly to the growth of maize as an input, potentially giving rise to other environmental concerns. Indeed, while specific environmental safeguards are explicitly mentioned in relation to the afforestation measure in the regulations underpinning the RDPs, this is not the case for other measures and those that are articulated within regional RDPs often may not be sufficiently strong to prevent environmental damage. Those measures whose focus is to increase competitiveness, while often offering opportunity for environmental benefits, provide the highest risk of potentially negative impacts on biodiversity, for example through payments for land consolidation, establishment of perennial energy crops, etc. To minimise the potential for such negative impacts on biodiversity, many commentators stress the importance of the SEA and ex-ante evaluations of the RDPs in assessing trade-offs and making sure that appropriate conditions and safeguards for all measures are in place. Requirements for sustainability assessments at the individual project level are also critical, as well as making sure that these requirements are enforced effectively (Boccaccio *et al,* 2009; Beaufoy and Marsden, 2010; ENRD, 2010; Hart *et al,* 2011b).

4.5 Other Intervening Factors

As set out in Chapter 2, there are a range of factors that can impact upon the success of achieving biodiversity outcomes on the ground that are unrelated to policy or agricultural management and which are, therefore, outside the farmer's control. These include *inter alia*:

- Variations in climate and weather;
- Hunting or other forms of killing of species, inside and outside Europe;
- Invasive alien species;
- Predators, including large carnivores, such as bears and wolves;
- Habitat loss taking place both inside and outside Europe that affects migratory species; and
- Incompatible actions taking place on neighbouring land.

Some of these factors can be controlled to varying degrees through the introduction of regulation, for example to control the hunting and killing of protected species, or support, for example to help protect species from predators, although the extent to which these interventions are effective in practice depends on adequate enforcement. Other factors, however, such as variations in climate and weather cannot be controlled.

Evidence on the impact of these factors on the implementation and effectiveness of policy measures is scarce however. Anecdotal evidence from the case studies and ecological experts underline the unpredictability that the presence or absence of large predators can bring to the success of agri-environment schemes, for example. Because the control of predators is usually not controlled by measures in the CAP or other policies, it is difficult to predict the impacts predators may have on scheme outcomes.

Another example of external factors involves the illegal killing of birds. This is recognised increasingly as having a significant impact on the status of bird species protected under the Birds Directive in the EU (see for example Magnin, 1991; Steiner 2006). A recent report by BirdLife has gathered data from 38 European countries on the illegal trapping and killing of birds (BirdLife International, 2011b). One of the main conclusions of the study is that the illegal killing of birds is much more widespread than is generally believed and a practice that very few countries have managed to stop. It shows that over 80 protected bird species are affected, many of which are species whose protection is the focus of policy measures under the CAP in the EU-27. The report highlights that, 'in many cases birds are killed for economic reasons: because they are perceived by land users as a competitor for resources, or as a source of income through illegal trade. In other cases birds are persecuted as trophies, due to ignorance of the law or just for 'fun'. Table 10 provides a summary of information from the study which shows the Member States where the illegal killing of bird species continues to be a problem, the trends over the past 10 years and the bird species affected.

Table 10: Summary of illegal killing of bird species in Member States and third countries

Issue	Member States where issue is widespread and considered to have at least a moderate conservation impact on bird species	Trend over past 10 years	Species Affected
Poisoning	Cyprus, Croatia, Macedonia, Serbia, France, Greece, Hungary, Ireland, Italy, Portugal, Slovakia, Denmark, Czech Republic, Bulgaria, Spain and the UK.	Increased: Spain, Portugal, Ireland, Hungary, Greece, France, Bulgaria, Czech Republic, Macedonia. Decreased: Poland, Cyprus, Denmark.	***Aegypius monachus, Aquila heliaca, Haliaetus albicilla, Milvus milvus, Aquila chrysaetos, Circus cyaneus, Gypaetus barbatus, Neophron percnopterus, Buteo rufinus, Milvus migrans, Hieraaetus fasciatus, Hieraaetus pennatus,*** *Falco peregrinus, Accipiter gentilis, Gyps fulvus, Circus aeruginosus, Buteo buteo, Corvus corax, Corvus corone*
Illegal Trapping	Cyprus, Croatia, France, Greece, Italy, Portugal, Czech Republic, Montenegro, Germany, Serbia, Spain and the UK.	Increased: Cyprus, Portugal, Bosnia and Herzegovina, Montenegro, Spain and Macedonia. Decreased: Sweden, Poland, Cyprus and Denmark.	***Crex crex, Melanocorypha calandra, Monticola solitarius, Upupa epops, Emberiza hortelana, Alauda arvensis, Carduelis cannabina, Phoenicurus phoenicurus****,Falco peregrinus, Accipiter gentilis, Accipiter nisus, Buteo buteo, Sylvia atricapilla, Sylvia elanocephala, Sylvia melanothorax, Sylvia communis, Sylvia curruca, Turdus philomelos,Turdus iliacus, Turdus viscivorus, Motacilla alba, Motacilla cinerea, Motacilla flava, Erithacus rubecula, Carduelis, cadruelis, Carduelis chloris, Carduelis chloris, Coccothraustes coccothraustes, Parus major, Parus caeruleus,Pyrrhulla pyrrhulla, Fringilla montifringilla, Fringilla coelebs, Serinus serinus*
Illegal Trade	Spain, Cyprus, Macedonia, Bosnia and Herzegovina, Slovenia, Hungary, Slovakia, Croatia, Italy, Portugal, Denmark, Ireland, Montenegro, Germany, and the UK.	Increased: Portugal, Spain, Hungary, Greece, Cyprus, Bosnia and Herzegovina, Montenegro, Macedonia and Serbia. Decreased: Poland, Germany, Bulgaria, Czech Republic, Austria and Norway.	***Alauda arvensis, Anthus campestris, Miliaria calandra, Melanocorypha calandra, Tyto alba, Otus stops, Athene noctua, Emberiza hortulana, Monticola saxatilis, Scolopax rusticola, Falco naumanni, Falco tinnunculus, Falco eleonorae, Falco biarmicus, Falco cherrug, Hieraaetus fasciatus, Hieraaetus pennatus, Circus cyaneus, Milvus milvus, Milvus migrans, Merops apiaster, Carduelis cannabina,*** *Accipiter gentilis, Accipiter nisus, Falco peregrinus,Falco subbuteo, Buteo buteo, Coccothraustes coccothraustes, Parus major, Parus caeruleus, Pyrrhulla pyrrhulla, Serinus Serinus, Fringilla montifringilla, Fringilla coelebs, Turdus spp., Emberiza spp., Carduelis spinus, Carduelis carduelis, Carduelis chloris, Tetrao urogallus*
Killing for	Bosnia and	Increased: Lithuania,	***Aquila heliaca, Aquila chrysaetos,***

control of predators	Herzegovina, Hungary, Bulgaria, Romania, Austria, Belgium, Sweden, Lithuania, Slovakia, Croatia, Germany, Spain and the UK.	Hungary, Germany, Estonia, Spain and Bosnia and Herzegovina. Decreased: Slovenia, Poland, Finland, Cyprus, Bulgaria, Denmark, Austria, Turkey and Belarus.	***Pelecanus crispus, Pelecanus onocrotalus, Circus cyaneus, Falco cherrug, Buteo rufinus, Athene noctua, Tyto alba, Haliaeetus albicilla, Hierraaetus fasciatus, Bubo bubo, Aegypius monachus, Neophron percnopterus, Ketupa zeylonensis, Merops apiaster, Aquila adalberti,*** *Phalacrocorax carbo, Ardea cinerea, Falco peregrinus, Falco subbuteo, Accipiter gentiles, Accipiter nisus, Circus aeruginosus, Buteo buteo, Pernis apivorus, Larus argentatus, Egretta garzetta, Corvus corax, Corvus corone, Garrulus glandarius, Pica pica, Gyps fulvus*
Killing in protected areas	Ukraine, Spain, Ireland, Bosnia and Herzegovina, Hungary, Bulgaria, Romania, Greece, Montenegro, Czech Republic, Sweden, Italy and the UK.	Increased: Montenegro, Bosnia and Herzegovina, Hungary, Ireland, Portugal and Slovenia. Decreased: Norway, Belarus, Croatia, Austria, Bulgaria, Cyprus, Greece, Romania, Germany and Poland.	
Killing for human consumption	Portugal, France, Italy, Croatia, Montenegro and Cyprus	Increased: Montenegro and Portugal. Decreased: Cyprus.	***Galerida cristata, Melanocorypha calandra, Calandrella brachydactyla, Alauda arvensis., Coturnix coturnix, Emberiza hortelana,*** *Fulica atra, Anthus sp., Fringilla montifringilla, Fringilla coelebs, Erithacus rubecula, Sylvia atricapilla, Sylvia melanothorax, Sylvia melanocephala, Sylvia communis, Sylvia curruca,* Laniidae*,* Anatidae*.*
Killing outside the legal season	Italy, Spain, Croatia, Bosnia and Herzegovina, Montenegro, Ukraine and Turkey.	Increased: Slovenia, Portugal, Montenegro, Armenia and Ukraine Decreased: Slovakia, Romania, Poland, Greece, Germany, Cyprus, Bulgaria, Denmark, Austria, Croatia, Belarus and Norway.	
Killing using illegal firearms or means of transport	Bosnia and Herzegovina, Ukraine, Greece, Armenia, Italy, Montenegro, Romania, Serbia, Turkey and the UK.	Increased: Greece, Ukraine and Bosnia and Herzegovina. Decreased: Romania, Germany, Estonia, Austria, Belarus, Croatia and Poland.	
Killing without a permit	Italy, Spain, Serbia, Ukraine, Greece and Montenegro.	Increased: Ukraine, Spain, Montenegro, Bosnia and Herzegovina,	

		Hungary, Ireland, Portugal and Slovenia. Decreased: Norway, Belarus, Croatia, Austria, Bulgaria, Cyprus, Greece, Romania, Germany and Poland.	
Killing for collection	Portugal, Spain, the UK, Slovenia, Croatia, Ukraine, Bosnia and Herzegovina, Serbia, Macedonia, Slovakia and Bulgaria.	Increased: Macedonia, Spain and Portugal. Decreased: Spain, Poland, Norway, Czech Republic, Belarus and Bulgaria.	
Killing protected species for 'leisure'	France, Norway, Germany, Italy, Denmark, Poland, Belarus, Czech Republic, Slovakia, Austria, Romania, Montenegro, Serbia, Ukraine, Bulgaria, Greece, Turkey and Cyprus	Increased: Armenia, Belarus, Ukraine and Montenegro. Decreased: Greece, Ireland, Norway, Poland, Serbia and Slovakia.	

Bold = Species with unfavourable conservation status in Europe
Source: BirdLife International, 2011b

5 ACHIEVING BIODIVERSITY GOALS THROUGH AGRICULTURE WITHIN A SUSTAINABILITY PERSPECTIVE

This chapter takes a step back from the policy responses needed to encourage the provision of biodiversity and ecosystem services through agricultural management alone to consider how to meet objectives for the conservation of biodiversity alongside the development of sustainable rural economies. In particular it focuses on the way in which the pursuit of economic growth and social prosperity can be achieved in a way that minimises any negative impact upon the biodiversity resource and where possible can use biodiversity as a capital asset upon which to build. It considers the different approaches needed in different parts of Europe. Focus is given to the situation in lagging areas, given the fact that it is these regions that are likely to be the focus of economic development activities in the coming years and there is a need to try and ensure that lessons from other regions in the EU are learned so that impacts on biodiversity are minimised.

While biodiversity policy targets and instruments seek to address the delivery of biodiversity benefits in the agricultural and other economic sectors, the economic, political and environmental context within which these measures operate is not static, and is influenced by a wide range of policy and non-policy drivers. Therefore Europe has to meet its biodiversity targets, while simultaneously addressing priorities for the broader economic, social and environmental sustainability of rural areas, including addressing new challenges such as climate change. Understanding how these different goals and processes inter-relate is central to identifying cost-effective means of delivering biodiversity priorities in the future, maximising synergies wherever this is possible and putting safeguards in place to minimise detrimental effects.

This chapter considers therefore, how biodiversity is affected by the wider economic and social development of rural areas in the EU from a historical perspective and how meeting the EU's biodiversity goals relates to current objectives and future priorities for rural areas. In particular, the chapter explores how these relationships vary regionally and how different areas of the EU have been affected over time. Drawing on evidence from available literature and the case studies, the ways in which pressures, opportunities and drivers in the rural economy have affected and continue to affect biodiversity, both negatively and positively are summarised. Building on this, the chapter examines the extent to which biodiversity is compatible with other key EU objectives for rural areas and concludes by considering the implications of this for policy.

In order to distinguish how farming, the rural economy and biodiversity interact in different places, as well as to examine the nature of trends, pressures and opportunities in each of these different contexts, a simple typology of rural areas has been developed, applicable at a sub-regional scale. This allows some of the key characteristics which tend to favour negative or positive biodiversity impacts to be identified, and their spatial and socio-economic differentiation to be highlighted.

5.1 EU rural development and biodiversity relationships

5.1.1 Overview and historical perspective

It is a long-established phenomenon of economic and social development, that as economies grow, the returns to the primary sector decline in relative importance. Less developed economies tend to be very heavily dependent upon agriculture and other primary activities both for employment and in respect of sources of wealth and added value. More developed economies have much larger secondary and tertiary sectors, reflecting the diversity of business opportunities and services that they support, and therefore the share of agriculture in employment and economic wealth is much smaller. At the same time, it is also common to observe in many development processes that the incomes of those engaged in primary production tend to lag behind those of people working in other sectors. Classically, this phenomenon is ascribed to the fact that farms tend to remain relatively small and spatially fragmented across the rural landscape, whereas businesses in other sectors tend quickly to agglomerate and attain economies of scale, from which it is argued that increased returns flow. Such analysis leads quickly to policies which seek to promote agricultural restructuring as a recipe for rural development. This thinking was evident, for example, in the EC's response to the so-called 'Mansholt plan' (Mansholt, 1968) partially implemented during the 1970s, in which aids for promoting farm modernisation, capital investment and the adoption of new technologies to increase farm productivity, were built into the CAP.

By the mid-1980s, however, a second strand of policy thinking in respect of rural development was incorporated within Community policy. Expounded within the 'Future of Rural Society' document of 1988 (European Commission, 1988), this analysis noted the rapidly declining role of agriculture within rural economic and social processes in Europe (not least because of agricultural restructuring stimulated by Mansholt-style development) and identified that as a result, future growth in rural socio-economic prosperity was unlikely to be delivered by agriculture alone. This document heralded the launch of a new range of rural policies seeking to promote economic diversification and upgrading of rural 'infrastructure', including physical and human resources, in order to stimulate more sustainable rural development (European Commission, 1996).

Finally, particularly during the last two decades, EU policy has embraced the notion of environmental integration (IEEP, 2010). This recognises that development which erodes the natural resource base upon which ecosystems, and the services that they provide to society, depend is ultimately self-defeating. As a result, rural policies now pursue a range of actions intended to tackle environmental degradation and meet major challenges including climate change, water protection and biodiversity preservation. The current EU rural development policy therefore combines objectives and measures in pursuit of all these different goals, including agricultural development, rural socio-economic diversification and environmental protection and enhancement (European Commission, 2006).

Throughout this period of European policy development, rural economies have undergone substantial restructuring and development, with profound consequences for biodiversity. The main patterns in recent years include:

- Changes in *the overall structure of rural economies*, including a decline in the share of agriculture and an increase in services;
- Significant *restructuring in agriculture and in rural land-use patterns and intensities*;
- *Differences in economic performance between regions*, including between relatively buoyant peri-urban or accessible areas and economically lagging regions;
- Variations in development trends, including decline and d*epopulation* in some areas and *urbanisation* in others (EDORA, 2010);
- Differences in the level of development between the *EU15 and EU12*, which has been encouraging greater rates of restructuring in the latter, with highly varying rates of development between individual new Member States.

As discussed in Chapter 2, the process of farm modernisation and restructuring which has occurred as producers seek to maintain income parity with other sectors, primarily by increasing productivity, has had significant biodiversity impacts in the more developed Member States (Baldock *et al,* 2002), and it continues to be an important driver of often negative pressures, in the less developed regions of the EU (Allina-Pisano, 2007). Rural economic diversification and increasing attention to providing rural infrastructure and improving quality of life in rural areas have been a stronger element in rural change in some localities than others in the EU-27, with mixed effects upon biodiversity. In some areas, such change accompanies peri-urbanisation of rural spaces and therefore may reflect increasing human pressure upon natural resources including biodiversity. However, in other localities economic diversification offers the potential to act as a counterbalance to agricultural restructuring, supporting a more multifunctional use and management of land and natural resources which can be beneficial to biodiversity protection (Dwyer *et al,* 2005). Finally, where other environmental priorities are driving rural change, such as water protection or climate change mitigation, both positive and negative biodiversity impacts can be observed or expected, depending upon the particular strategies adopted at a local level and their sensitivity to biodiversity concerns. The evidence of current changes in rural economies in different parts of the EU-27 and their biodiversity implications are considered in the following sections.

5.1.2 Structural characteristics of rural economies

Relative dependence on the primary sector is now highly variable between the predominantly rural areas (PRA – defined according to the OECD definition, at NUTS 3 level) of different Member States. Those PRA with at least 20 per cent of the workforce employed in agriculture[36] include many in Greece, Poland, Portugal, Romania and Bulgaria and one or two in Slovenia and Austria, while those with the lowest proportion are found in parts of

[36] Agriculture and fishing, as defined in Eurostat, NUTS3 data, 2008 figures

Sweden, Denmark, the Netherlands, Belgium, Scotland and a range of German Länder. The EU rural areas with lowest productivity per unit of labour in agriculture include Slovenia, Poland, Latvia, Lithuania, Estonia, Bulgaria, Hungary and one region in Spain. The highest are Sweden, Netherlands, and a small number of regions in Italy and Germany. There are some instances where the relative wealth or performance of agriculture outstrips the rural economy more broadly, creating a degree of social tension, particularly where a large share of EU funding is devoted to agricultural development – this has been noted in some of the new Member States in recent years (Dwyer *et al,* 2008a; 2008b). Eurostat data indicate a decline in rural labour productivity in a few regions of Germany, and rural Romania, between 1999 and 2004, suggesting socio-economic decline which is associated with rural exodus in some areas and with a rapid increase in input prices combined with a drop in agricultural employment in other areas (Swinnen and Vranken, 2009). These trends followed significant restructuring, and they were only a temporary phenomenon, however similar patterns may now be expected to emerge in those countries which have been hit hardest by the global economic crisis, including rural Greece and Ireland.

Sectoral balance and employment in the rural economy can be relevant to biodiversity considerations. The classic pattern in Europe's rural areas has been of a relatively high proportion of the working population employed in agriculture and other primary industry, although today the tertiary sector can often be an equal or more important source of employment, particularly in leisure and tourism. Some rural areas currently suffer high levels of unemployment, often as a result of a decline in the farm workforce as farms have modernised and capitalised, while other business has tended to concentrate in urban and peri-urban areas with better transport access and infrastructure. In some areas of central and Eastern Europe, the shrinkage of large-scale manufacturing in the 1990s led to a rural in-migration of ex-urban workers who returned to their families' farms in the hope of making a living off the land (Swinnen and Vranken, 2009; Davidova *et al,* 2010). This resulted in a resurgence of semi-subsistence agriculture that played a stabilising role (Kostov and Lingard, 2004), and slowed down, stopped or prevented trends towards farm modernisation and enlargement which might otherwise have stimulated greater biodiversity losses (Beaufoy and Marsden, 2010).

5.1.3 Rural economic performance

Classically, rural areas tend to lag behind urban areas economically in respect of measures of wealth, which is often related to a high relative dependence upon primary sector businesses, which tend to have more limited ability for adding value. Another important feature of rural areas which distinguishes them from urban areas has been a relative predominance of small and medium-sized enterprises (SME) and micro-businesses, due to the scarcity of settlement patterns and the relative absence of the kinds of major infrastructure needed to support larger industries[37].

Evidence suggests there is a wide range of variation in GDP per capita across the rural areas of the EU-27 (Dwyer *et al,* 2008a; 2008b). Based on 2004 data, it is clear that not all rural

[37] There are of course important exceptions to this – for example in the new Member States where very large farms were created in some areas through central planning and these persist today.

areas exhibit 'lagging' characteristics, and some are actually wealthier than their urban counterparts. The highest levels (over 125 per cent of the EU average) were in rural Sweden, Denmark, Finland and parts of Ireland, plus a few areas in the UK, Germany, Italy and Austria. The lowest levels, at only 10 per cent of the EU average, were found in Bulgaria and Romania.

These data indicate the degree to which large rural areas in the EU still face the considerable challenge of rural poverty. More generally, the persistence of rural regions which are less wealthy than the EU average is notable in Greece, southern Italy, the Iberian peninsula, more remote areas of France and the UK, north-eastern Germany and most of the new Member States. In 2009, the greatest share of EU-27 population at risk of poverty was in thinly populated areas (21 per cent), with a spread between the EU-12 and EU-15 from 24 to 19 per cent[38]. In those Member States with a high poverty risk (Romania, Bulgaria, Latvia, Lithuania, Greece and Spain), poverty in sparsely populated areas affects a higher proportion of the total population. In particular, there is a higher than average risk of poverty among young people (under 15 years old) in the sparsely populated areas in the EU-12, with 45 per cent in Romania, and 35 per cent in Lithuania, Bulgaria and Latvia. Greece and Spain have the highest incidence of this (29 and 27 per cent, respectively) in the EU-15. In 2009 the proportion of elderly people (over 65 years old) at the highest risk of poverty in sparsely populated areas was particularly high in Bulgaria, Estonia and Spain (between 35 and 43 per cent) (European Commission, 2011e). These figures explain the continuing priority placed upon rural economic development in many Member States.

The emerging economies in the new Member States have been obliged to make rapid adjustments, in order to manage exposure to both EU and global markets, following decades of isolation and, in some cases, almost feudal landholding structures. In common with some convergence regions[39] within the EU-15 (notably including Portugal and some parts of Greece), there remain large sections of their territories where farming is characterised by many small holdings producing at low levels of output, with an important social and semi-subsistence economic role (Birol, 2006; Scrieciu, 2011). The importance of multifunctionality in small-scale farming, and its capacity to incorporate local and traditional farming techniques into agricultural knowledge, science and technology, has recently been identified as a model that is applicable globally given that it is capable of meeting both environmental and poverty reduction goals. Some research suggests that small holdings have proven resilient in the face of economic uncertainty, acting as a buffer against poverty and a basis for diversification, as well as delivering rich ecosystems, cultural heritage and quality food (Kostov and Lingard, 2004; Birol, 2006; IAASTD, 2008; Beaufoy and Marsden, 2010; Davidova *et al,* 2010; UN, 2011). Nevertheless, agricultural growth and farm modernisation are frequently seen as an important element in the route out of rural poverty, and some research has found that they can play a role in the evolution of

[38] 'Thinly populated areas or areas with less than 100 inhabitants per km^2 are defined by the level of urbanisation of the local administrative unit in the EU Statistics on Income and Living Conditions.

[39]. The 'convergence' areas are defined in the EU regional policy as the areas eligible for support under the convergence objective, including the regions eligible on a regional criteria basis (GDP is less than 75 % of the Community average) and Member States who are eligible for the Cohesion Fund on a national criteria basis (GNI less than 90 % of the European average). This is specified in the General Regulation 1083/2006/EC in article 17 of the Preamble.

sustainable economies, if carefully designed so as not to override biodiversity considerations, specifically within high nature value areas (Csaki and Forgacs, 2009; Beaufoy and Marsden, 2010). Where such conditions do not apply, however, there is ample research evidence to show that a lack of political will may combine with a low level of awareness about biodiversity impacts and implications among local actors, leading to the neglect or destruction of habitats or features which are dispersed across the landscape (Beaufoy *et al,* 2011).

At the EU-27 level, a general trend for growth in GDP/capita in rural areas over the 1999-2004 period is evident (Dwyer *et al* 2008a; 2008b). However, in a small number of areas (four eastern Länder in Germany and eight regions in Greece) GDP/capita declined, and in many areas in a variety of Member States the increase was lower than the average for the EU-27. By contrast, some areas, particularly in new Member States, exhibited dramatic increases (over 50 per cent in Slovakia, Romania, Bulgaria, Poland, Lithuania, Latvia, Estonia, Hungary, and also some regions of Ireland). Since 2004, analysis of data for a selection of old and new Member States[40] suggests that rural GDP/capita has continued to increase, on average, up to 2008, notwithstanding the wider economic difficulties faced by many countries over this period. However, a negative GDP/capita trend was recorded in rural Ireland, Sweden and the UK after 2006, reflecting the particular economic challenges faced in these countries as a result of the global financial crisis.

Typically, when rural areas experience rapid or sustained economic growth, this increases the demand for land for non-agricultural purposes (for example, housing or industrial units), and/or it may indicate a more intensive use of the land which remains in farming. However, when rural economies experience a downturn it is usually the most economically vulnerable activities which cease, which may lead to some land abandonment where production is neither competitive nor serving a subsistence purpose and smaller businesses often contract in number, generating unemployment. In many parts of the EU, such areas coincide with areas of high nature value, where low-intensity agricultural management is critical to the preservation of such value.

The relationship between the wider rural economy and farm diversification can be highly relevant to biodiversity. Analysis has found that the rural territories where more than 40 per cent of farms have diversified were found most frequently in Ireland, Cyprus, the Czech Republic, the western Länder in Germany, and also Denmark, Estonia, Finland, Malta, Sweden, Slovenia, Slovakia and England, plus one region each in Spain and Italy (Dwyer *et al,* 2008a; 2008b). This study noted that, 'this group of territories includes some areas with high agricultural productivity and higher than average GDP/capita, as well as others where these aspects are weak'. This suggests that multifunctional agriculture can be found in both wealthy and less developed rural areas.

Diversification on farms can offer an economic development strategy with benefits to biodiversity, particularly where the diversification involves eco-tourism or low-impact leisure activities, or adding value to the products of environmentally-sensitive farming

[40] Specifically, Sweden, UK, Portugal, France, Austria, Greece, Hungary, Ireland, Lithuania and Poland.

systems through direct sales, labelling and/or differentiated marketing (Beaufoy and Marsden, 2010; Čierna-Plassman, 2010, Morgan *et al,* 2006). Whilst the converse is also possible if the forms of diversification are less sustainably-oriented, the occurrence of win-win diversification strategies is a notable feature of significant parts of rural Europe.

The nature of the broader rural economy can be a critical determinant of the scope for beneficial diversification, in respect of providing the upstream facilities to enable differentiated processing and marketing of eco-produce, and/or in offering sufficient local purchasing power to underpin these developments. Simply put, if a rural territory has no small shops, hotels, abattoirs or even people with business skills to enable farmers to find local processing or marketing opportunities, this will be a barrier to biodiversity-friendly diversification (Blaas and Varoščák, 2006; Hubbard and Hubbard, 2008; Čierna-Plassman, 2010; Redman, 2010). In addition, unless the product can easily be sold via long-distance methods like the internet (as has proved possible for rural tourism, for example), a local customer base is frequently essential.

In respect of tourism development, the economic importance of this sector is greater in the rural areas of the EU-15 than it is in many of the new Member States. This may be an important influence upon biodiversity-beneficial diversification opportunities, enabling more positive trends (eg linking sustainably-produced farm products to nature tourism) to develop in the old Member States (Europarc, 2001; Čierna-Plassman, 2010).

5.1.4 Population trends

When rural areas lose population, especially young people, this can be a classic cause and/or symptom of rural decline, with implications for the management of land and features both on and off farms. On the other hand, areas which experience significant or rapid population growth, perhaps due to counter-urbanisation and the development of commuting lifestyles, or the in-migration of older people seeking retirement in the countryside, or young people returning to the family farm when urban and industrial employment opportunities collapse, are also of interest. These different trends have different implications for biodiversity in rural areas, both within and beyond the farm.

Population in the predominantly rural areas (NUTS 3) of Member States grew in some and declined in others in the five years after 1999. Those with steady growth over this period included the predominantly rural areas of Belgium, the Netherlands, and most of rural France, Hungary and Ireland, while steady decline was seen in Lithuania and most of Poland over the period (Dwyer *et al,* 2008a; 2008b). The declines in both Lithuania and Poland have continued up to 2009, and a decline is now apparent in rural areas of Hungary, over the full period 2001-2009. In the old Member States, the general pattern is of net population growth in predominantly rural areas up to 2009, even in countries with lower levels of economic wealth such as Portugal.

New migrants to rural areas may increase pressures on biodiversity associated with farmland through the impacts of new housing and infrastructure dissecting the landscape. On the other hand, new household plots or hobby farms may increase biodiversity in otherwise industrialised monoculture agricultural landscapes, in some areas. They may also provide the necessary customer base to make certain forms of diversification possible, as discussed above.

5.1.5 *Institutional capacity and skills*

The level of skills and institutional capacity in relation to the management and governance of rural resources are also key influences upon the development of rural areas and these factors will also influence biodiversity. There are no readily quantifiable indicators of human and institutional capacities and capabilities in respect of effective biodiversity awareness and management. However, as discussed in Chapter 4, there is much evidence to suggest that where farmers have a high level of awareness of the environmental implications of their management practices and where governance institutions are strong and also well-informed about biodiversity, its value to economic development and its requirements, protection and enhancement are much more likely to occur. There is also much evidence to show how a lack of such institutional capacity and/or farmer awareness can create significant barriers to the effective adoption and implementation of biodiversity-friendly policies and practices.

Ensuring effective partnerships and collaboration between the different government departments involved in the development of rural areas, agriculture and the environment as well as with economic, environmental and community stakeholders and interest groups is an important starting point for ensuring effective policy design. This is particularly important where sustainable solutions need to be found in relation to the development of rural areas and potential conflicts or trade-offs between economic, social and environmental priorities need to be resolved. As highlighted in Chapter 4, collaboration of this sort can lead to new, innovative approaches being found to deliver integrated, sustainable solutions and can facilitate greater buy-in to the implementation of the policy which can help improve its effectiveness in practice. Ensuring effective and open channels of communication and consultation, however, takes time and this should not be underestimated if the value of partnerships and collaborative working are to be maximised.

In essence, greater understanding among both policy beneficiaries and policymakers/administrators will favour biodiversity conservation and these understandings can be mutually reinforcing and synergistic when policies are designed and implemented through locally responsive and partnership-based approaches.

5.1.6 *Renewable energy generation in rural areas*

One trend that is increasingly affecting rural economies across the EU, but which cannot yet be monitored using standard datasets, is the use of rural land for the generation of energy, most often to increase energy security and to contribute to climate change mitigation goals. When land is diverted for wind farms or large-scale solar power installations, or used for the growth of bioenergy crops, this land is generally no longer usable for agriculture and there can be localised negative implications for biodiversity. Where running water in streams and rivers is used for hydroelectric purposes, the impacts upon biodiversity require careful planning, to minimise long-term damage to fish stocks and other aquatic biota. On the other hand, bioenergy generation based upon anaerobic digestion of farm wastes may enable these wastes to be rendered safer for application to land than they would have been prior to this treatment. In that way, pollution risks to biodiversity – especially in small watercourses which cross farmed land – may be reduced.

5.1.7 Examples from the case studies

As highlighted in the preceding sections, the economic and social trends in rural areas in the EU-27 vary enormously depending on a whole range of factors. Some of the trends affecting biodiversity in different ways in different regions are illustrated by examples from the case studies. The different patterns demonstrated are set out in Box 30.

There is limited evidence from the case studies of linkages between agricultural biodiversity and wider socio-economic pressures. However, the Southern Transylvania and Baden-Württemberg case studies demonstrate that contrasting trends in rural economies and populations can exert differing pressures on biodiversity. In Southern Transylvania in Romania, the majority of the rural population suffers from poverty and endures poor social and technical infrastructure. For example, only 33 per cent of rural residents are connected to a water supply network and only ten per cent to a sewerage system, while only ten per cent of rural roads are considered of 'adequate standard' with asphalt cover and only few potholes (MAFRD, 2007). At the same time, traditional markets for agricultural products – especially liquid milk and dairy products – have declined due to the collapse in milk prices and pressure from food hygiene legislation. Combined with the ageing population and on-going migration of younger people out of the rural communities, there is an increasing tendency towards declining numbers of farm animals; the gradual marginalisation of less productive and/or less accessible parcels of land; and in some cases, the total abandonment of farmland and dwellings.

In contrast, Baden-Württemberg is economically one of the best performing federal states in Germany. Baden-Württemberg is somewhat exceptional in comparison to the other German states as it has a very low average age of population (40 years in 2003; 42 in 2007). Population growth has slowed slightly in the recent past. The majority of growth (> 80 per cent) can be attributed to economically-motivated net in-migration of German citizens and foreigners. Strong economic performance and in-migration have led to pressure on biodiversity from the loss of rural land to built development.

These examples illustrate the way in which these wider socio-economic trends may combine or co-exist in different contexts, depending upon different types of natural and cultural conditions. They suggest that, in order to gain more detailed understanding of these relationships and to determine how best to foster positive biodiversity outcomes, a typology focussed at a smaller geographical scale (sub-regional) is necessary (see Section 5.3).

Box 30: Examples of the relationship between biodiversity and rural development in the case study countries

Diversification varies widely, being relatively rare in the Czech Republic, but widespread in Southern Transylvania (Romania) and Baden-Württemberg (Germany), where many holdings are part-time and rely on other sources of income. The Romanian example in particular indicates the positive effect of micro-level variation in agricultural management on biodiversity which is related to the persistence of very small holdings. Some similar impacts are suggested in wealthier rural areas of England and some parts of Greece, due to land purchase for hobby farming and leisure use, although the retention of land management skills in these cases may be poor, leading to some negative impacts on biodiversity.

Bioenergy markets are considered to have driven land use and crop changes, and specialisation, in Baden-Württemberg (Germany) and the Czech Republic, with negative consequences for biodiversity suggested.

Farm employment has declined across all the case study regions. One example of the impact on biodiversity comes from the Czech Republic, where it was noted that a decline in small scale farming and a contraction of the agricultural labour force has made it difficult to contract in labour for some traditional management practices.

The **fragmentation of land holdings and reversion to semi-subsistence management** is a trend that was observed in Southern Transylvania (Romania). This is shown to have had some positive effects on biodiversity by reducing the intensity of land use, restoring the traditional fine-scale mosaic landscape, and reducing levels of mechanisation, but the trend is not ongoing.

Land use change through urbanisation is highlighted as a pressure on biodiversity in Baden-Württemberg (Germany) and in France. In parts of Southern Transylvania (Romania), there is a trend towards local people selling accessible parcels of meadow and pasture land for the construction of holiday homes and guesthouses, contributing to the loss of semi-natural grasslands, even in protected areas. **Abandonment** is identified as either an existing trend or a threat in most of the case studies, affecting upland areas of England, Romania and LFA areas in the Czech Republic, as well as some areas in Greece. Negative effects on habitat diversity through scrub encroachment are noted in Baden-Württemberg (Germany).

Different trends and pressures associated with the **restructuring of rural economies** are highlighted in different case study regions. In Southern Transylvania (Romania), poverty and poor rural infrastructure are leading to out-migration and contributing to land abandonment. In contrast, strong economic performance and population growth have increased the pressure on biodiversity from the loss of rural land to built development in France. In England, some positive opportunities for biodiversity arise from purchase and management of land by conservation groups.

5.2 Biodiversity and its relationship to other policy objectives in rural areas

As noted above, in the past economic growth in rural areas has often occurred at the expense of biodiversity. As a consequence, efforts to conserve biodiversity have tended to be seen as a constraint upon rural development. More recently, however, a much more varied appreciation of this relationship has developed and more attention is being paid to the complementarities that exist between biodiversity and the achievement of other economic, social and environmental objectives. Although conflicts continue to arise, there is increased recognition of the opportunities that biodiversity can offer for sustainable rural development.

The Europe 2020 Strategy (European Commission, 2010b) sets out a vision of Europe's social market economy for the 21st century, based on three mutually reinforcing priorities:

- Smart growth: developing an economy based on knowledge and innovation.
- Sustainable growth: promoting a more resource efficient, greener and more competitive economy; and
- Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion.

The strategy stresses the need for economic transformation following the recent economic and financial crisis, highlighting the need for this to be sustainable so that it respects resource constraints. Given that the EU's rural areas account for 91 per cent of the territory and 59 per cent of the population of the EU27, generating 48 per cent of overall Gross Value Added and supporting 56 per cent of employment (European Commission, 2011m), they clearly have an important role to play in meeting this vision. Particular challenges for rural areas include the need to promote economic growth and increase employment; reduce disparities in economic performance, particularly by stimulating growth in lagging rural regions; enhance resource efficiency and meet the challenges of mitigating and adapting to climate change; and contribute to the growth of the green economy.

These challenges are reflected in specific policy priorities set out in the 2010 Commission Communication on The CAP towards 2020 (European Commission, 2010i). This calls for agriculture to contribute to the overall objectives of smart, sustainable and inclusive growth as set out in the EU2020 strategy through contributing to three overarching objectives. These are:

- Viable Food Production – contributing to farm incomes, improving competitiveness and compensating for natural constraints to address the threat of land abandonment.
- Sustainable Management of Natural Resources and Climate Action – securing environmental public goods, fostering green growth through innovation and pursuing climate change mitigation and adaptation.
- Balanced Territorial Development – supporting rural employment and maintaining the social fabric of rural areas, promoting diversification and allowing for structural diversity in farming systems.

One of the key challenges for biodiversity, therefore, is how to ensure that adequate account is taken of biodiversity priorities and needs in meeting these objectives.

5.2.1 Biodiversity and socio-economic development

The provision of biodiversity and ecosystem services provides both opportunities and constraints to the development of rural economies. While there is increasing evidence of the opportunities that maintaining and enhancing biodiversity may provide for employment, tourism and rural diversification, it is clear that in some situations protecting biodiversity may also restrict built development and constrain land management activities. The case studies highlight both synergies and perceived conflicts between biodiversity and socio-economic development in rural areas. These are set out in Box 31.

Box 31: Examples of the relationship between biodiversity and socio-economic development in case study countries

- Most case studies highlight that measures that benefit biodiversity also tend to enhance landscape and bring benefits for tourism and recreation. However, the Romanian case study highlights that, while potential benefits may be recognised, firm evidence of the real impacts is often lacking and that in some situations the development of tourism infrastructure is taking place in ways that is detrimental to biodiversity.

- In the Czech Republic, there is a prevailing attitude that biodiversity is a barrier to economic growth. This is exacerbated by the low degree of connection of agriculture to the rural economy – most farms are large commodity producers and diversification is rare, except to develop biogas, linked to maize. As a result, the potential synergies between agriculture, biodiversity and rural development are undeveloped and where increases in maize production are experienced, this has the potential to undermine biodiversity goals.

- The Baden-Württemberg (Germany) case study found very little interface between biodiversity and socio-economic development in rural areas, suggesting that they tend to be treated as different issues and that opportunities for synergies have not been fully identified or exploited.

Biodiversity and economic development – conflicts and opportunities

Actions to deliver biodiversity benefits were often considered to be in conflict with economic development in rural areas in the past. In particular, economic development of the agricultural sector has resulted in widespread intensification, consolidation and specialisation of farming systems, with adverse effects on biodiversity (see Chapter 2), but biodiversity has also been affected by built development in rural areas, as increasing prosperity and economic development in rural areas of the EU has led to significant loss of, or damage to, habitats and populations of species. Efforts to protect biodiversity are often seen as imposing constraints on rural economic growth largely through their impacts upon land use. A recent report on the opportunity costs of biodiversity conservation (Kaphengst *et al,* 2011) highlighted examples where efforts to protect biodiversity has restricted development opportunities at a local and sometimes regional level. However, since such development is often diverted to alternative locations, the extent to which there are negative impacts at the national or EU level is debateable (Kaphengst *et al,* 2011).

There are also potential threats to biodiversity from economic activities that could address the green growth agenda in relation to other environmental objectives, such as renewable energy generation by wind farms, large solar installations, tidal barrages as well as the use of agricultural land for the production of bioenergy crops. These tensions emphasise the need for 'green growth' projects to take account of all potential environmental costs and benefits, not just climate change mitigation, in their development.

Tensions between biodiversity and rural development can also occur in the implementation of the EU's rural development policy. Considerable mention is made within the legislative texts of the need for measures to contribute to the 'sustainable development' of rural areas. All RDPs must be subject to Strategic Environmental Assessment in the ex-ante planning stage, but this is necessarily done at a relatively general level which may not anticipate all the situations in which conflicts might arise. In addition, the EU's Environmental Impact Assessment legislation requires Member States to act to minimise environmental damage from agricultural developments and other 'projects' in rural areas. However, the degree to which these provide an effective mechanism to minimise conflicts in all cases is dependent on the way in which the EIA Directive is implemented in Member States, and this has been shown to be very variable (COWI, 2009). The only explicit mention of the need to avoid environmental damage in relation to a specific measure within the EAFRD is in relation to the first afforestation measures, whereby 'any first afforestation should be adapted to local conditions and compatible with the environment and enhance biodiversity' (preamble 38 of Council Regulation 1698/2005). Although fewer conflicts are evident than in the previous programming period, some conflicts continue to occur in certain areas between biodiversity and measures for the modernisation of agricultural holdings and the development of infrastructure more generally, particularly through land consolidation and diverse activities to support water management (irrigation, drainage, new access roads, etc.). Whilst the examples that exist appear to represent a minority of cases, they are particularly evident in southern and eastern European Member States, where agriculture and the rural economy are less developed and are under pressure to modernise and become more competitive (Farmer *et al,* 2008b; Boccaccio *et al,* 2009; ENRD, 2010).

Other policy instruments may act to reduce the incidence of these conflicts in future. For example:

- The Natura 2000 network provides a high level of protection for the EU's most important nature sites, covering 18 per cent of the territory of the EU27. This should mean that development is focussed on areas of lower biodiversity value;
- Agricultural policy reforms, including the decoupling of support from production, the introduction of cross compliance, and the minimum spend requirements on environmental measures, including the agri-environment measure, have reduced conflicts between agricultural development and biodiversity by removing policy incentives for damaging practices and providing new opportunities for biodiversity friendly farming to enhance rural incomes; and
- Conserving biodiversity is now seen as an integral component of sustainable development. The recent EU Biodiversity Strategy and the proposed future EU Green Infrastructure Strategy aim to highlight the multiple benefits of biodiversity conservation in this wider perspective.

A growing body of evidence has highlighted the scope that biodiversity and ecosystem services offer for the sustainable development of rural economies and their potential to contribute to the EU2020 'green growth' agenda. Biodiversity is increasingly recognised as providing economic benefits and development opportunities for rural areas. A summary of the range of socio-economic benefits that can accrue from biodiversity are set out in Box 5-3.

Specifically In relation to agriculture and rural areas more generally, further contributions to the growth of the green economy can be achieved by adopting new technologies, developing new products, changing production processes, and supporting new patterns of demand, notably in the context of the emerging bio-economy. The 'green growth' agenda may offer a number of opportunities to biodiversity and provide the impetus to build on existing synergies. For example the development of green technologies and methods in agriculture (such as for biological waste treatment, pollution control, sustainable pest control and sustainable water management) can have benefits for biodiversity. In addition, there are opportunities relating to the creation of jobs and new development opportunities in environmental management and related activities, both in protected areas and the wider countryside as well as the development of mechanisms that recognise and support the provision of ecosystem services to the wider economy and community.

Box 32: Opportunities for biodiversity to contribute to the economic development of rural areas

Maintaining and enhancing biodiversity can help provide a range of socio-economic outcomes including:

- **Increased opportunities for tourism** to the local area/region, thereby providing a beneficial impact on the local economy. For example:
    - opportunities for marketing the area on the basis of its landscape/ biodiversity etc;
    - increased opportunities for recreation;
    - opportunities for farmers to diversity into tourism related activities, for example the provision of bed and breakfast facilities, encouraging educational visits etc.

- **Changes in employment opportunities** both on and off the farm. For example:
    - On farm – changes in the number of employed or family labour for undertaking routine management or capital works for biodiversity;
    - On farm – changes in the number of contractors hired to carry out additional management or capital works for biodiversity
    - Off farm – the generation of jobs in upstream/downstream businesses.

- Opportunities for **adding value to food/other products**.

- The maintenance of traditional agricultural **skills** or the development of new skills.

- **Investment** being attracted to the local area, for example investment in second homes or businesses relocating to the area, which in turn provides increased employment opportunities for local people.

- **Impacts on population** levels in rural areas, for example slowing down outmigration.

- Benefits for **cultural heritage**, for example where measures focussed on environmental provision have also helped to maintain rural traditions, cultural events (ie wine/olive festivals), thereby maintaining and enhancing rural identity etc.

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Source: based on ENRD (2010)

Biodiversity as a source of employment: Carrying out biodiversity focussed land management activities has been shown to create jobs and development opportunities both within protected areas and in the wider landscape. There are a number of examples that demonstrate the role of Natura 2000 in creating employment and jobs. For example, the implementation of the Natura 2000 network was considered to have positive impacts on GDP in Spain, with an estimated increase in GDP between 0.1 - 0.26 per cent at national level. In general, it was estimated that the network would generate an additional 12,792 jobs to the country (Fernandez *et al* 2008 cited in Farmer *et al,* 2008b). A study of the economic value of protected areas in Wales (including Natura 2000 sites) concluded that they directly or indirectly supported nearly 12,000 jobs, generated a total income of approximately €250 million and €300 million in GDP (National Trust, 2006). It is estimated that the full implementation of the Natura 2000 network requires annual expenditures of €5.8 billion, but is currently constrained by a shortage of available funding (Gantioler *et al,* 2010; Kettunen *et al,* 2011). Nonetheless it has been estimated that a fully funded Natura 2000 network could support 207,000 jobs and GVA of €5.2 billion across the EU, mostly in rural areas (Gantioler *et al,* 2010).

There is also a growing literature on the socio-economic benefits generated by agri-environment measures and their application across Europe. From these studies, it seems clear that the pursuit of environmental management offers potential for participating farms to employ more people and increase income in a number of indirect ways, for example through added-value food marketing which is linked to the environmental credentials of the production system. The degree to which this potential is realised in practice depends upon the way in which agri-environment schemes are designed and delivered, as well as the particular characteristics of the farming systems involved. Typically, schemes which tend to stimulate only the maintenance of extensive production or further extensification of management (such as through the reduction of inputs) would tend to have a negative impact upon farm employment. In contrast, those which explicitly support the restoration and management of hitherto neglected environmental features on farms are much more likely to have knock-on benefits for employment and the social fabric of rural areas.

A study on the employment impacts of the Environmental Stewardship agri-environment scheme in England estimated that an average of 1.32 FTE jobs were created in the local economy (within 40 minutes travel distance from the farm) for every €1.3m of initial agri-environment scheme funding (Mills *et al,* 2010). This increase in employment opportunities was particularly related to the capital works required for field boundary maintenance and restoration. These schemes were also found to help retain regular employment for local businesses, including stone walling and hedge restoration contractors, and some farm advisors. While these figures may look modest it should be remembered that these are not job creation schemes but payments given for an environmental purpose, which have a positive side-effect upon local employment.

Biodiversity, ecosystem services and green infrastructure: Much of the analysis of the benefits of biodiversity in recent years has focussed on its role in underpinning ecosystem services. While biodiversity is recognised as having intrinsic values, arguments for its protection are increasingly based on evidence that the diversity within ecosystems plays an important role in influencing the services that they provide to people.

Ecosystem services determine the productivity of the primary sector, provide opportunities for tourism, recreation and the creative industries, and provide essential regulating services such as clean air and water, and protection from floods and natural hazards, which are essential to support human life and economic activity in both rural and urban areas. Indeed, the maintenance, enhancement and restoration of biodiversity, including the sustainable exploitation of genetic resources, offers potential new applications for business and society.

While current commercial potential should not be exaggerated, there is evidence of the potential future benefits of protecting biodiversity. For example, in England, the role of protected areas in conserving wild relatives of crops with potential for future agricultural production has been demonstrated (Maxted *et al,* 2007).

The value of ecosystem services and the economic consequences of their loss are highlighted by the Economics of Ecosystems and Biodiversity (TEEB) study[41]. The growth in interest in ecosystem services highlights the value that rural land managers can provide for society and the economy as a whole, and will stimulate new opportunities for income generation. Green infrastructure – creating networks of natural and semi-natural areas and features that provide ecosystem services to society – may represent one such opportunity. Green infrastructure includes farmed and forested land as well as protected areas, green corridors, parks and green urban spaces, wetlands, coastal areas and features such as green roofs. Maintaining, restoring and expanding green infrastructure is seen as being increasingly important in mitigating and adapting to climate change, in providing cost effective solutions to the management of natural resources and protecting against natural hazards, in supporting recreation, and in enhancing human health and the living environment. New and innovative approaches to harness green infrastructure have the potential to increase its role in the green economy, potentially taking the place of 'grey' (man-made) infrastructure in many areas. The European Commission is working on the development of an EU Green Infrastructure Strategy, which will seek to enhance awareness of the importance of green infrastructure in Europe, and encourage its maintenance, restoration and expansion.

5.2.2 Biodiversity and viable agriculture

Biodiversity and the viability of agriculture are closely inter-related. Given that farming accounts for 42 per cent of the EU land area, its viability and future development have profound impacts on biodiversity, which in turn provides both opportunities and potential constraints for farm businesses. The links between biodiversity and the viability of the agricultural sector are complex and there are examples of both complementarities and trade-offs.

The existence of High Nature Value (HNV) farming systems demonstrates that in the past, high levels of biodiversity were consistent with the development of viable farming systems – HNV systems arose from the development of traditional farming practices, which were able to produce both food and environmental goods in a complementary way, over many centuries. However, HNV farming has become increasingly threatened in recent decades, receiving less income from the market and from CAP Pillar 1 direct payments than more intensive systems, or not being eligible for Pillar 1 direct payments at all. HNV farms generally have lower net incomes than non-HNV farms, and often have negative net incomes. In some areas, attempts to enhance the viability of HNV farming systems by boosting production have affected biodiversity negatively (IEEP, 2007). In other areas,

[41] http://www.teebweb.org/

gradual abandonment of these HNV farming systems indicates that the maintenance of biodiversity and the viability of farming are both under threat (Dwyer *et al,* 2010).

In the past, efforts to enhance the economic viability of farming through investment in structural change and technological development have often facilitated the intensification of agriculture, and contributed to the widespread loss of biodiversity in agricultural systems, through increased input use, irrigation, and/or habitat loss and fragmentation. While price support under the CAP is seen to have been a major driver of these trends in the past, alongside market and wider economic trends, decoupling has now reduced the impact of agricultural policy in this mix (Baldock *et al,* 2002). Nevertheless, pressures continue to arise from market developments influenced by wider policy (for instance, enlargement of the single market, which increases competitive pressures on all farms). The dairy sector, for example, faces significant pressures to consolidate into fewer, larger holdings due to a mix of market and regulatory impacts which are affected little by the persistence of quotas, and this is leading to more concentrated environmental risks in the sector. In many of the new Member States, agricultural production generally remains less intensive than in the EU-15, but market opportunities, investment grants and increasing pillar 1 income support to farm households may act together to accelerate modernisation and specialisation, which may have negative impacts on biodiversity.

Other studies have demonstrated that species and habitat diversity can enhance food quality and enable farmers to gain premium prices for agricultural produce, helping to offset the effects of lower production volumes. In some cases, this positive linkage is explicit, in that biodiversity-friendly conditions are built into the unique selling point of the products (food, fibre and tourist/leisure facilities) produced in an environmentally sustainable manner. For example organic farming is identified as balancing objectives for viable food production and biodiversity conservation in several of the case studies (for example Baden-Württemberg, England and France) and some products registered for geographic identifications under the EU food quality policy are also beneficial for maintaining valuable semi-natural habitats and farming in remote agricultural areas (for example in Germany and Spain - see Chapter 3). In other cases the linkage may only be implicit, which may suggest a greater vulnerability to market pressures which might encourage the weakening of these links, in order to expand production, over time.

From a sustainability perspective, it is possible to argue that the future viability of certain types of agriculture in the EU, with relatively high land and labour costs, may rely on their ability to deliver public goods such as biodiversity and vice versa. It is argued that because people value biodiversity in EU agriculture, farmers should be offered opportunities to receive support for biodiversity management, for example through agri-environment schemes or payments for ecosystem services (PES), and scope to enhance their incomes through market mechanisms such as adding value to a diverse range of products based on biodiversity credentials. In marginal areas with HNV farming systems, policies aiming to simply maintain farming activity will contribute to the provision of high levels of biodiversity and the viability of agriculture.On the other hand, improvements in infrastructure, access to markets, and the enhancement of economic viability through diversification, for example are also priorities in HNV farming systems, in new Member States in particular, although not exclusively. Packages of CAP Pillar 2 measures providing this sort of support and extension services in addition to the land based payments for delivery of biodiversity are much needed.

Notwithstanding these considerations, highly intensive and specialised farming systems have now developed in many parts of the EU. Many of these systems are relatively low in biodiversity value, and, while there is considerable potential for enhancing their role in providing biodiversity through sympathetic management of field margins, other interstitial areas and modifying in-field crop management, farmers in these areas often see their continued viability as depending upon the maintenance of intensive, low biodiversity farming systems. The restoration of wildlife habitats or encouragement of more diverse farming in these areas is viewed as having a significant negative impact upon productivity, and claimed to be in conflict with the goal of viable food production. Perhaps more challenging is the fact that this kind of farming continues to increase in coverage across the EU27, at the present time, increasing pressures on biodiversity. In these contexts, it would often appear that productivity and biodiversity are incompatible goals.

Indeed there were a number of examples from the case studies where real or perceived conflicts between biodiversity and viable food production were highlighted. For example, the England case study highlighted conflicts between biodiversity and agriculture in intensive systems, despite increasing opportunities from agri-environment measures and growing demand for organic and conservation grade food. It was suggested that this might lead to a polarisation of farming systems in future, with intensive commodity production in some areas and more conservation focussed agriculture in others. The French and Czech case studies highlighted the fact that the perceived conflict between economic and biodiversity objectives among policy makers were limiting opportunities for biodiversity conservation, despite some evidence of 'win-win' opportunities for farm incomes and biodiversity objectives at a local level. In Greece, the existence of large carnivores highlights the conflict between biodiversity and food production, for example honey production which is threatened by bears, and wolves are also subject to persecution by farmers to protect their livestock.

To set against this, however, there is growing evidence that increases in biodiversity, by contributing to ecosystem services, can contribute to enhanced crop yields in already intensive, biodiversity poor agricultural systems. It is argued that biodiversity within agricultural systems contributes to the delivery of essential ecosystem services (such as pollination, pest regulation, nutrient cycling, and microclimate regulation) that support agricultural production and that only a water, soil and climate-friendly agriculture will be able to secure lasting productivity. If modern agriculture depletes soil resources, pollutes water and destroys populations of beneficial soil organisms or disease/pest-controlling native species, the resilience of the agro-ecosystems is reduced and they become more vulnerable to future stresses like climate change or new and more virulent diseases. It can be argued, therefore, that the maintenance and enhancement of farmland biodiversity plays a key part in ensuring Europe's capacity for long-term food security, especially in the context of changing climatic conditions, while the unsustainable intensification of EU agriculture to enhance global food production could lead to further degradation of natural resources at the cost of biodiversity and long-term agricultural productivity. This positive role for biodiversity and ecosystem services is supported by research findings summarised in the

France case study, which are set out in Box 33. Further investment in research on the ways in which high yields and biodiversity can be achieved together, as well as finding ways of translating innovative approaches for management into practice, will be important to increase the understanding and acceptance of biodiversity as part of a forward looking agenda for the development of the agricultural sector. The proposed development of a European Innovation Partnership for agriculture (European Commission, 2010c) could provide a useful catalyst for this.

Box 33: The importance of biodiversity and ecosystem services for agricultural production

Research has shown the value of biodiversity and ecosystem services for agricultural production. For example:

- Pollinators maintain the production of specific crops (eg sunflower, rapeseed);
- Maintaining richness of plants and herbivore arthropods helps to control invasive plant species;
- Species diversity of permanent grasslands enhances animal health and the quality and nutritional value of dairy products;
- Habitat diversity enhances soil stability, water availability, climate mitigation, pollination, and pest control;
- Species diversity in crops and grassland contributes to enhanced yields over time;
- Plant diversity has a positive effect on water availability, water quality and flood control.
- In the 'Grands Causses' area of France, farmers have a symbiotic relationship with Griffon Vultures, which remove livestock carcasses, thus reducing the costs of their disposal.

Source: French Case Study

Therefore, maintaining, enhancing and restoring biodiversity in relation to agricultural practices, particularly where it is explicitly rewarded through policy support or through the development of a niche market for products, can enhance the level and/or stability of farm incomes**.** However, commonly it may also limit other (less sustainable) opportunities to raise incomes, for example through agricultural intensification. Biodiversity provision may similarly have positive or negative effects on the competitiveness of the agricultural sector, for example by raising costs but offering the potential to add value to agricultural products or gain additional income from diversification into tourism and leisure markets. However, compensating for production difficulties in areas with natural constraints, such as those at risk of abandonment, has the potential both to enhance the viability of food production and to maintain biodiversity.

It is clear from this analysis that the relationship between biodiversity and the viability of agriculture is not straightforward and varies between different contexts and farming systems. It is likely that the maintenance and enhancement of biodiversity will contribute to the viability of agriculture and food production in many parts of the EU, but that in other areas, efforts to enhance viability by increasing production will come at the expense of further biodiversity loss.

5.2.3 Biodiversity and climate action

Agriculture is a major emitter of greenhouse gases, accounting for 9.2 per cent of overall EU emissions in 2007. A report by the European Commission, examining the role of EU agriculture in climate change mitigation (European Commission, 2009e), identified the following priorities for climate change mitigation:

- Reducing emissions from farming activities – through optimisation of fertilisers and agricultural inputs, and improved management of livestock and manure;
- Reducing carbon losses from – and enhancing carbon content of soils – through:
  - Improved soil management (reduced or no tillage, maintaining ground cover, protecting carbon rich soils (peatlands, wetlands and grasslands), restoring degraded peatlands and wetlands, and restoration of degraded soils at risk of erosion or desertification.
  - Changes in land management - diversified crop rotations, maintenance of set-aside areas and plantation of woody plants, such as hedgerows; maintenance and protection of permanent pastures and conversion of arable land to permanent grassland; use of crops adapted to wet soil conditions (eg reeds) as an alternative to wetland drainage; organic farming; and afforestation.
- Saving energy – through efficiency measures in buildings, equipment, machinery and field operations;
- Production of biomass and renewable energy.

Examples exist where climate objectives both complement and conflict with biodiversity conservation objectives. With regard to climate change mitigation, measures to reduce farm inputs, promote more sustainable soil management, protect and restore habitats that store carbon, take areas of land out of production and protect hedgerows are all likely to be beneficial to biodiversity. However, other measures involving changes of land use, through afforestation or biomass production, could be detrimental to biodiversity, especially where they affect High Nature Value farming systems. In relation to bioenergy production, the potentially damaging effect of the 10 per cent transport fuel target under the Renewable Energy Directive on biodiversity has been highlighted in relation to its potential Indirect Land Use Change (ILUC) impacts. Evidence suggests that, the demand to grow additional first generation feedstock crops to meet this target is likely to cause the conversion of grassland or other uncropped land into arable production, particularly if there is no reduction in the demand for the growth of food crops (Bowyer, 2010). This is already being witnessed in some parts of Europe, where the more productive grassland is ploughed up to plant bioenergy feedstocks, requiring semi-natural grasslands to be improved agriculturally to replace the productive grassland (Oppermann, pers. comm.).

Climate change adaptation in agriculture is likely to involve a variety of different adaptation measures. Farm level measures include timing of farming operations, technical solutions, choice and development of crop varieties, improved pest and disease control, more efficient water use, enhanced soil management and use of more hardy livestock breeds. At the sectoral level responses may include changes in crops and varieties (informed by agricultural research and experimental production), advice and awareness rising, measures to promote more efficient water resource management and irrigation, and measures to promote risk and crisis management.

The role of biodiversity and ecosystems in climate change adaptation is increasingly emphasised. Agriculture can, for example, assist in watershed management, the protection of habitats and biodiversity as well as in the maintenance and restoration of multifunctional landscapes. Species conservation can be facilitated by increasing the resilience of species-rich habitats to climate change and establishing ecological networks on agricultural land, and the water holding capacity of grazing land can be used to reduce the risk of flooding. The role of agriculture in providing such 'green infrastructure' could be recognised and further enhanced within the CAP. While current agri-environment measures contribute to this objective, they may not always enhance sufficiently the resilience of habitats or the connectivity between areas protecting biodiversity, suggesting a need for measures on a territorial scale beyond the level or individual farms to help successful adaptation.

It therefore appears that measures to promote climate change adaptation are complementary to meeting biodiversity goals, while mitigation measures may be complementary in many cases but potentially conflict with biodiversity objectives in others. Biodiversity and climate objectives can be addressed synergistically, providing that areas of potential conflict (such as the risk of damage to habitats caused by energy crops or afforestation) can be successfully addressed. The different relationships between objectives for biodiversity, climate and sustainable management of natural resources, as highlighted in the case studies, are set out in Box 34.

Box 34: Examples of synergies and conflicts between biodiversity and climate change

In **Baden-Württemberg (Germany)** and the **Czech Republic**, there are regional tensions between bioenergy schemes and biodiversity objectives.

In the **Czech Republic**, the promotion of organic and integrated farming through agri-environment schemes has brought about reductions in greenhouse gas emissions and reduced water pollution due to the reduced use or banning of fertilisers and pesticides. Biodiversity is a secondary, rather than a primary objective of these schemes. Support for grassland management has also led to reductions in fertiliser use and hence greenhouse gas emissions, and has motivated farmers indirectly to convert arable land to grassland, contributing to carbon storage and the sustainable management of soils.

In **France**, agri-environment measures designed to conserve the Little Bustard in Poitou-Charentes involve the conversion of arable land to grassland, which enhances carbon sequestration as well as providing a wide range of benefits for water quality and quantity, prevention of soil erosion nutrient leaching, and the enhancement of landscapes and wider biodiversity.

The **French, Greek and English** case studies reported no major current conflicts between biodiversity conservation and other environmental objectives. In England, win-wins with climate objectives are identified through restoration of habitats (eg peatlands) and increasing connectivity and the natural resilience of habitats across the country.

In **Southern Transylvania** (Romania), emissions of carbon dioxide and nitrous oxide from traditional biodiversity rich pastoral systems are low, due to low usage of fertilisers, energy and machinery. These grasslands also act as important carbon sinks. Support to maintain these HNV farming systems therefore also has important climate benefits.

5.3 Characterising impacts - a typology of rural areas

As can be seen from the preceding sections, there is a broad range of evidence assessing the linkages between biodiversity associated with agriculture, and wider trends in the development of agriculture, rural economies and communities. However, the key systemic relationships between these different elements and what this means for the development of synergies or avoidance of conflicts for biodiversity within the context of future trajectories for the development of rural areas will vary in different parts of the EU, depending on a their differing agricultural and socio-economic characteristics. This point is particularly apparent from the case studies, where frequently, discussion of biodiversity pressures is related closely to the specific farming systems and/or socio-economic character of different territories within each case study country (eg pastoral, dairying areas in Baden-Württemberg in Germany, marginal uplands in England in the UK and subsistence farming and pastoralism in southern Transylvania in Romania). It is also clear from the case studies that such characteristics can vary almost as much within individual Member States and even regions, as between them.

To allow for a degree of spatial differentiation at the EU level between different kinds of area facing different main pressures because of the dominance of particular systemic characteristics, a typology has been developed, which will help to allow priority areas for policy action and policy change to be pinpointed and targeted more accurately. The typology operates at a sub-regional scale and has been developed using criteria related to:

- the agricultural character of the territory;
- the rural socio-economic character of the territory; and
- the nature and degree of linkages between these two different spheres of activity, because this also has an important influence upon how they affect, and are affected by, biodiversity considerations.

Any typology can only be approximate in capturing the great diversity of rural areas of Europe, but in order to be conceptually useful, it should be simple to describe and yet sufficiently detailed to have wide resonance across the 27 Member States. Four types of rural areas have been identified. These are described in Box 35 below.

Box 35: Typology of rural areas

<table>
<tr><th>Type</th><th colspan="2">Description</th></tr>
<tr><td rowspan="3">TYPE 1</td><td colspan="2">1. Areas where agriculture is modernised, individual farms are relatively large and/or specialised by comparison with the EU average, and rural economies are not heavily dependent upon farming, being diversified and hosting a range of other sectors and activities. There are then two main variants here:</td></tr>
<tr><td>Type 1 A</td><td>Type 1 B</td></tr>
<tr><td>Those areas where agriculture is strongly integrated with the wider rural economy through high levels of pluriactivity, diversification and strong linkages eg with agro-tourism, local quality products, farm forestry, up and downstream industries and employment, etc. Drawing from the evidence available, these areas are likely to be found mainly in EU-15 countries and especially those areas which retain relatively small farm sizes despite high standards of living, rural population growth and higher than average rural economic growth.

Such areas could include parts of Austria, France, Germany and northern Italy, as well as possibly some parts of England, Benelux and southern Scandinavia. Among the new Member States, some larger parts of the Czech Republic and Hungary also share these basic characteristics. Elsewhere in the new Member State, these areas are likely to be much smaller and/or more difficult to distinguish, due to the generally rapid pace of change in many such rural economies and farm sectors.</td><td>Those areas where agriculture produces mostly commodity outputs for global markets and thus there is a marked disconnect between farming and the rural community and economy. These would typically be areas with highly specialised agriculture, unable to provide much for the food needs of their rural populations – for instance, the arable plains of northern France and Germany as well as Eastern England; or the concentrated horticultural and intensive livestock areas of Brittany and north-east Germany, as well as some parts of Poland and the arable plains of other eastern areas in the new Member State, and places where very large, former collective farms have retained dominance in regional agriculture. Economic research on rural economies and linkages with agriculture suggest that large-scale, specialist monoculture agriculture typically has very low economic interlinkages with the wider rural economy. However, there are some types of high-value specialist farming which nonetheless maintain strong rural economy interlinkages via tourism and gastronomy: notably the wine-growing areas of much of central France and Germany, as well as many vineyard landscapes in southern Europe. Such areas would belong more in type 1A than in this type.</td></tr>
<tr><td>TYPE 2</td><td colspan="2">Areas where agriculture may be relatively well-structured / modernized (by comparison to type 3, in particular) but where it, and the wider rural economy in which it sits, is particularly challenged by remoteness, poor growing conditions and general marginality in both environmental and socio-economic terms, compared to other rural areas. In these areas, although farming itself employs few people, there are also few other sources of local employment, and thus the up- and downstream sectors to farming are socio-culturally important and taken together with farming itself, they are significant influences upon the rural economy. The main challenge for these areas is marginality, and sustaining all economic and cultural activity in the face of strong competition from more productive/economically buoyant parts of Europe. In this type of area, the scale of farming activity is a less important distinguishing feature than the relative marginality of it and the rural economy as a whole. Also, the degree of interlinkage between farming and the rural economy may be variable. This type would embrace many of the mountainous and less-favoured areas of the EU-27 in both old and new Member State, as well as some of the islands in both northern and southern Member State.</td></tr>
<tr><td>TYPE 3</td><td colspan="2">Areas where agriculture is predominantly small-scale, and not modernised (in respect of use of new technologies, mechanisation, specialisation, etc), farms remain small and focussed significantly around longstanding 'traditional' production systems. They may or may not produce</td></tr>
</table>

	for markets – thus we capture both the remaining subsistence farmland areas AND the areas of very small and relatively impoverished, market-oriented agriculture in some southern and eastern parts of Europe, in this type. The areas described in the Romanian case study, as well as significant areas in northern Portugal, island Greece and southern Italy, could fall into this type. It would also be relevant to southern Poland and significant parts of some of the Baltic states, as well as Bulgaria and possibly other less developed areas in Hungary and Slovakia, parts of Spain and Ireland and the Scottish islands.

The main trends that have been identified for agriculture and the wider rural economy's relationship with biodiversity are intensification, specialisation and abandonment in agriculture as well as rural economic diversification, population change and economic growth and prosperity in rural areas. These trends play differently in these different types of area.

Type 1B areas: In these areas the dominant agricultural trends remain intensification and specialisation, although competition for land from other uses may also be important (as illustrated in the France and Czech case studies), and the pace of such change is probably slower than in some other areas because farm structures are already relatively competitive. Abandonment in these areas is unlikely and should only occur in cases where small pockets of difficult land become uneconomic to manage. In populous areas (as illustrated by the England case study) these plots tend to be sold out of agriculture and managed independently, for example for woodland amenity or for recreation, which may be either positive or insufficient for biodiversity needs (for example, insufficient where fragments of grassland have no animals to maintain grazing).

Looking ahead, the existing agriculture in these areas may be heavily dependent upon the use of fossil fuels through chemical inputs and machinery and they may exhibit some significant negative characteristics for biodiversity, such as degraded soils, lack of interstitial habitats and linking features in landscapes, and few niches for species requiring in-field habitats. Thus from a sustainability perspective, these systems are not sustainable, even though they may represent currently the most profitable types of farm due to scale and low cost bases. In the wider rural economy, population pressures may be significant in some areas but economic diversification is generally limited and/or not linked to land and biodiversity resources.

Type 1A areas: These areas may be affected by intensification and specialisation but probably to a lesser extent than other types, due to the diversity of income sources of most land managers and thus their ability to consider and deploy a wide range of alternative business strategies to cope with fluctuating fortunes in farming. Also, abandonment may occur in some areas but its impacts should be localised. This kind of landscape is typified by some of the more economically-prosperous areas of Austria, Germany, France and Italy, although it is not clearly represented in the Baden-Württemberg case study. In future, the existing agriculture in these areas should be more sustainable and resilient than that in type 1B areas, although the heavy use of fossil fuels and the occurrence of soil degradation may still be important in some localities. The key factor is that because farms are fully integrated into a wider and healthy rural economy, with alternative income sources, value-added capture in respect of their products or successful on-farm diversification, they do not face the same pressures to change, in response to changing conditions in agricultural markets.

Type 2 areas: Here the whole rural economy struggles to compete with other areas because of marginality. These types of areas are spread widely across the EU and there are examples of such areas in most of the case studies. As economies globalise, competitive pressures on landscapes increase and these pressures are felt by both farm and non-farm sectors. In these circumstances, abandonment and intensification strategies can co-exist, in that some landowners give up the fight while others attempt to survive by increasing in size and cutting costs radically. Land with reasonable productive potential is at risk of damage from over-exploitation, while land with very low potential risks being damaged by low-cost, insensitive management or it may be left unmanaged. Without strong opportunities for income generation off-farm or through diversification and adding value, farm populations decline and farms enlarge, and communities and economies also decline.

However, in some areas these landscapes can develop some of the attributes of type 1A areas, particularly where the tourism and leisure economies are strong and these offer some scope for farms to become involved, either directly entering these sectors, or supplying quality local products to them. These areas face significant challenges of sustainability, as the current trends tend towards the zoning of land use into areas that are neglected and those that are over-used, leading to losses of biodiversity. Many of these areas are currently relatively biodiverse, including a large proportion of HNV land. The main potential for enhanced biodiversity would seem to come from new economic activities which could be competitive in these areas, independent of farming. Examples include e-business as well as increased added-value product development and integration with the tourism and leisure economies of these areas. By injecting new sources of non-agricultural income into these landscapes and communities, part-time farming might be sustained as an essentially marginal but culturally valued activity, or it might build new opportunities for competitiveness based upon environmental branding of farm-based products (food, fibre, leisure). However, the development of non-farm options must be planned so as to minimise inappropriate forms of development, and there may be limitations on the extent to which agricultural activities can be sustained by cross-subsidy. Another possibility is long-term public or private sector support for explicit ecosystem services delivery (for example water quality or carbon storage), which could bring much-needed investment into retaining functioning agro-ecosystems and their management.

Type 3 areas: These areas are most evident in the case studies of Romania and Greece and their existence at present appears fragile and their future uncertain. Economic growth and development seem almost inevitably to be set to destroy their coherence and biodiversity value, particularly if such development is unplanned and reliant upon individual actors. Some currently 'undeveloped' farms will be taken on by people who seek to amalgamate holdings and thereby install modern farming approaches at a larger scale. Landscape features will be destroyed and mechanisation introduced, and these farms will outcompete smaller ones for land and other resources. The pattern will be similar to that which has already affected many former HNV farming systems across Europe. The end result will be either type 2 or type 1 areas, most probably type 1B. However, if the changes could be steered towards a type 1A, that could at least preserve some elements of value for biodiversity. Finally, it is possible that the fragility of the existing situation could be removed and structures stabilised, to some extent, by institutional factors, for example adopting the

Scottish crofting model or similar approaches which persist in some areas of Italy, whereby farming becomes explicitly part of a protected culture of very small-scale and multi-purpose land management and economic activity, chosen and maintained by people who are committed to this particular style of life. This sort of landscape generally requires legal protection and institutions which are committed to its retention and persistence into the future.

5.4 Common themes and implications for policy

The characterisation of rural areas into four discrete types highlights a number of common elements in respect of opportunities to favour biodiversity.

Firstly, it is evident that agriculture can be 'embedded' within a wider regional economy and community in ways which reinforce the direct economic value of biodiversity as a feature of farming systems and practices, as is the case with organic farming, or high value-added products linked to explicit farming practices which protect biodiversity, or eco-tourism or low-impact, sustainable leisure developments which celebrate and protect biodiversity. As demonstrated in chapter 3, positive relations can also exist for specialist farm products designed for more distant markets, in which brand image and/or niche marketing play a more significant role, for example, the EU PDO products that integrate beneficial land management prescriptions for local semi-natural habitats into the product description (see Box 3-20) or 'slow food' producers who market their outputs on the internet. In all these cases, biodiversity is valued as an asset for the local economy.

Secondly, the existence of a mix of policy and non-policy drivers that is able to maintain a degree of balance or stability in the farmed landscape (of farm structures, farming communities and their skills and knowledge) for relatively biodiverse landscapes, managed by longstanding agricultural practices, is important. These need to be developed where they do not currently exist. At the same time, policies should be developed ideally to allow for micro-scale diversity in management between holdings in such areas rather than pursuing fixed management prescriptions across the whole landscape, as is sometimes seen in agri-environment schemes.

Finally, a high level of environmental awareness among farmers and rural communities is a critical factor for ensuring biodiversity provision. This will influence how different types of area respond to current and future drivers of rural change. Where such awareness is already relatively high, it needs to be maintained and expanded by ongoing networks of communication and learning. Where it is not yet high, sustained effort may be required in order to address this issue, through advice, information, promotion and training actions.

The evidence for the ability of a region to build on its environmental, cultural and social assets to derive an economic benefit has been widely documented (OECD, 1998; 2006). A review of recent trends in added-value products in England suggests that 'there is a new generation of inventive farm businesses who are producing high quality food on ecologically significant landscapes. In a number of cases, these entrepreneurs are relatively new to farming but bring to it dynamic and innovative approaches that combine focussed production chains, niche marketing and often highly organised specialist retailing. A second model, just as common but very different, is comprised of more longstanding farm businesses who seek to realise the latent value of their unimproved pastures in response to perceived consumer demand. Both are actively 'creating' value and in doing so are actively managing and maintaining valuable, but threatened, ecological formations and landscapes, not as a form of service agriculture but as a critical component of production. In many cases, this has gone hand in hand with more traditional forms of diversification such as direct marketing, the setting up of farm shops and involvement in local food networks, all of which can have further positive knock-on effects on local employment. This kind of agriculture has been termed 'ecologically embedded', meaning that the food produced from such farming depends, for its brand image and marketing success, upon the ecological credentials of the management by which it is produced (Morris and Kirwan, 2010).

This phenomenon is not yet mainstreamed across the EU-27, however, and in many situations, biodiversity objectives may be antagonistic to economic growth and prosperity. Policy will need to provide the right incentives to address this. However, examples of 'ecologically-embedded' agriculture and other rural economic activities (eg eco-tourism, sustainable/green leisure and service businesses) have been identified in many different Member States, including older and more developed rural areas as well as less-developed areas in new Member States. As illustrated in Chapter 3, CAP Pillar 2 measures have played a role in this regard, although their potential is still not fully utilised. To a large extent, a synergistic relationship depends on specific trends or patterns in agricultural restructuring and economic development being present and interlinked in a coherent system in a particular region. Biodiversity, as an important component of ecosystems and green infrastructure, is increasingly seen as an essential capital asset, which requires maintenance and investment. The maintenance and enhancement of biodiversity has been shown to offer opportunities to generate income and employment, both directly and by stimulating opportunities for rural tourism and recreation. These arguments are increasingly used by environmentalists in support of new initiatives to halt biodiversity loss.

The occurrence of 'win-win' situations where biodiversity is supported by sustainable rural development depends, to some extent, on the nature and extent of valued ecosystem services associated with farmland biodiversity. However, it also requires elements of human and social capital in the form of good environmental awareness and cultural support for biodiversity, significant institutional capacity, as well as strong links between the protection of natural assets and rural economic activity. Sometimes these links are maintained through explicit policy measures (for example agri-environment schemes), but often they are the product of a 'green growth' commitment among local entrepreneurs, which may not have been an explicit outcome of policy. Although trade-offs are likely to occur, particularly in the least developed regions where capital investments in farm holdings and rural infrastructure are needed to improve the economic viability of agriculture and quality of life, they have to be negotiated and dealt with in an informed way, taking lessons from the past, and be made in the full knowledge of the value and opportunities associated with farmland biodiversity, so as to ensure that detrimental impacts on species and habitats are avoided wherever possible. It is important that economic development should be sustainable in nature, respecting the basic principle that action to deliver one objective should not damage interests under another.

The debate about whether conserving biodiversity represents a constraint or opportunity for rural economic development is of particular importance in lagging rural regions, given the EU's commitment to achieving balanced territorial development. Less developed rural regions are often rich in biodiversity assets, but in greatest need of new development opportunities. The experience of much of northern and western Europe is that traditional rural development pathways focussing on commodity production and the development of built infrastructure are harmful to biodiversity, and that conserving biodiversity depends on new ways of rewarding the multiple services that semi-natural systems provide to economy and society. The increasing focus on green infrastructure, ecosystem services and the development of the green economy undoubtedly offers opportunities to balance these priorities, seeking to minimise or avoid traditional conflicts between biodiversity and economic development.

Achieving rural social and economic development while safeguarding biodiversity, is likely to depend on a variety of measures, including:

- Effective implementation of planning and site protection policies;
- Stronger biodiversity proofing of policies that finance investments in the economic development of rural areas (including the CAP and Structural Funds as well as national, regional and local development programmes), to identify and address potential conflicts;
- Maximising the opportunities that existing measures (such as agri-environment, forestry, other rural development measures, environmental awareness-raising/training initiatives, as well as cross-compliance) offer to balance biodiversity and development objectives;
- Identifying, fostering and exploiting new opportunities for green economic growth, including investment in green infrastructure, payment for ecosystem services, promotion of community renewable energy initiatives and sustainable tourism, and development of the green knowledge economy in rural areas;
- Highlighting and promoting positive examples of the opportunities and benefits that biodiversity provides to rural economies much more widely among all rural actors, in order to influence attitudes and enhance support for biodiversity conservation;
- Supporting the establishment of institutional and community/economic structures which recognise and seek to uphold the small-scale diversity in some particular agricultural landscapes that encourage multiple biodiversity benefits (for example, part-time farming areas in the Austrian and Italian alps, and Crofting communities in northern Scotland, both of which are supported by particular structures of local governance (Shucksmith, 2010).

Based on the evidence in this chapter, there appears to be particular scope to use the concept of green growth, applied at the sub-regional territory scale and to whole economies, rather than just to the farm sector, to identify sustainable development trajectories that identify and explicitly valorise biodiversity assets and potential. This implies using a wide range of rural development policy instruments in combination, achieving biodiversity aims alongside the development of green infrastructure and delivery of ecosystem services, moving away from a more traditional notion of aligning only specific instruments with specific goals.

The long-term sustainability (economic and social as well as environmental) of development pathways should be a paramount concern, which requires balancing environmental objectives with socio-economic ones through the use of public policies. Integrated approaches to achieving future CAP goals are, therefore, essential.

Considering which policy approaches and instruments can best promote and support these trends, the following appear to have most potential:

- Advice and training to increase biodiversity understanding and to develop entrepreneurial skills and confidence among land managers and rural communities, in respect of opportunities to develop new 'eco-businesses';

- Bottom-up strategic development of institutional capacity for biodiversity appreciation and conservation, encouraging partnerships between environmental agencies/NGOs and farm/rural communities to identify and address biodiversity concerns;

- Improved communication between the environmental, agricultural and rural development authorities at the national level, including improved stakeholders' consultation in Member States relating to key priority setting, the development of strategic documents and rural development plans.

- Improved guidance to Member States on ways to avoid biodiversity damage in the design and implementation of the measures with other objectives and to mobilise the potential of such measures to deliver biodiversity benefits synergistically.

- A combination of basic and targeted payments addressing the three strands of sustainability (including agri- and forest-environment; rural green infrastructure investments; sustainability planning tools and diversification/tourism aids) to be used in integrated ways, adapted to local circumstances and opportunities. Underpinning legislation to recognise and protect biodiversity from undesirable land-use and management changes, properly implemented and enforced, reinforced by cross-compliance and strengthened impact assessment processes.

6 ACHIEVING BIODIVERSITY CONSERVATION THROUGH AGRICULTURE AS A STRATEGIC PRIORITY

Building on the evidence provided in the preceding sections, this chapter explores the way in which biodiversity and ecosystem services associated with agriculture can be delivered as a strategic priority in the EU. The term 'strategic' implies a response that is clear and relatively ambitious about its objectives, but is also forward looking, recognising the challenges that may arise to face biodiversity in the future. Looking ahead, the CAP will continue to play a central role in delivering biodiversity through agriculture as a strategic priority in the future. The broader policy context is also critical, however, as delivering biodiversity and ecosystem services through the agricultural sector cannot be seen in isolation from rural development and the delivery of other environmental, social and economic objectives in rural areas. The way in which the strategic priorities for achieving biodiversity conservation through agriculture interact with other EU strategic objectives and policies for climate, renewable energy, resource efficiency, green growth and territorial cohesion, is critical, therefore, as is the interaction of CAP instruments with the targets and policies associated with these EU strategies.

Looking to the future, the following sections consider the different types of policy approach needed to deliver strategic priorities related to the protection of biodiversity and ecosystem services associated with agriculture in order to contribute to meeting the EU's 2020 biodiversity target and sub targets. The nature and design of the CAP instruments required to deliver biodiversity and agro-ecosystem services will depend not only on the nature of the management needed in a particular agricultural habitat, but also on a range of political, economic and institutional factors.

It then proceeds to consider the range of other relevant EU policy initiatives that operate alongside the CAP and explores some of the current and potential synergies and conflicts that arise.

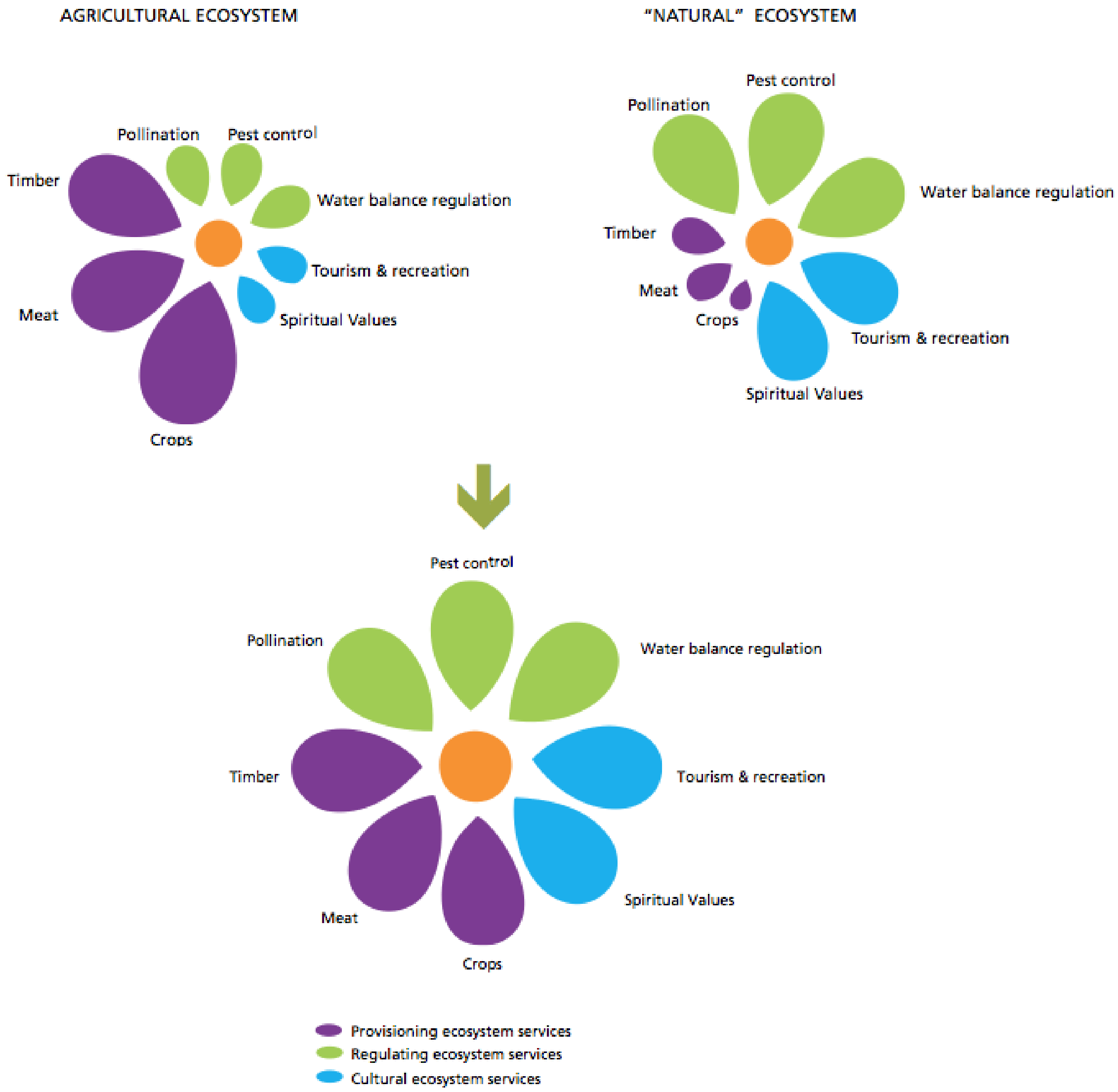
6.1 Summary of the issues continuing to face biodiversity conservation

Biodiversity continues to be valued highly by the public. Over the past few decades, concern for the decline of many valued species and habitats has prompted a range of policy responses to counter these declines, both in the form of regulatory protection, for example through the Birds and Habitats directives, but also through the introduction of payments to farmers and other land managers to encourage practices that benefit biodiversity. A key focus of such support has been the agricultural sector, given its major influence on the state of biodiversity and ecosystem services in the EU-27. The CAP continues to be the most significant funding instrument with potential for contributing to biodiversity goals associated with agriculture as well as those linked with associated rural development activities, such as farm diversification, tourism and so on.

The policy debate on biodiversity is shifting and increasingly it is framed by the concept of ecosystem services. This can be a helpful framework to illustrate the challenges facing the delivery of biodiversity within agricultural systems, where the goal is to secure non productive ecosystem services, such as water quality, pollination, valued landscapes and of course biodiversity itself from agricultural land, alongside creating favourable conditions for producing crops, livestock and energy. Finding the right balance between the delivery of these different types of ecosystem services and the interdependencies between economic, social and environmental needs, so that agricultural land is managed sustainably in the long term is one of the key challenges facing policies aiming to maintain, enhance and restore agricultural biodiversity (European Commission, 2011l; TEEB, 2011; UNEP, 2011). This challenge is visually depicted in Figure 3.

Addressing this challenge requires an integrated approach that identifies win-win opportunities wherever possible, whilst recognising the importance of potential conflicts that may occur and trade-offs that may need to be made. Solutions on the ground will vary in different parts of the EU-27, according to local conditions. In some situations the maintenance of existing farming systems and land management practices will be the key priority, while in others changes in management will be needed, particularly to enhance biodiversity within more intensive farming systems or where more targeted management is needed to address the needs of specific habitats or species. Increasingly, innovation in production methods and/or management practices will be needed to find ways of increasing food production in the long term, without damaging the environment and biodiversity.

Figure 3: Integrated Ecosystem Service Delivery



Source: UNEP, 2011

The preceding chapters have demonstrated that, while real progress has been made in attempts to reverse the declines in agricultural biodiversity in the EU-27 in recent years, the pressures facing biodiversity are such that this has been insufficient to meet the targets that were set for 2010. This means that a step change is needed if the new 2020 biodiversity targets and the related agricultural targets under the new Biodiversity Strategy are to be met in the next eight years.

To deliver a step change requires action on several different fronts, with the CAP a key component of the strategy:

- Biodiversity priorities and objectives in relation to agriculture need to be articulated clearly at the EU level and integrated into the CAP as well as other relevant EU policies and translated into appropriate actions at the national and regional level;

- The spatial scale over which agricultural biodiversity is delivered needs to be increased significantly to ensure that biodiversity thrives in the wider countryside as well as in protected areas;
- The legislative framework currently in place to protect Europe's most valued biodiversity needs to be fully implemented and adequately enforced to provide a sound foundation on which other policy measures can build;
- As biodiversity is a public good it cannot be delivered through the market, therefore sufficient public funding needs to be available where needed to support its provision on agricultural land, above and beyond that which is required by law.
- The design of policies, the nature of the measures they contain (broad brush, targeted etc) and the way in which they are implemented needs some improvement, particularly to ensure that policy measures are used in ways and combinations that address the priorities identified in relation to the local situation and that foster collaboration and deliver benefits at the landscape scale;
- Gaps in understanding of the agricultural management requirements to provide the ecological needs of particular species need to be filled;
- An increased emphasis is needed on advice, information dissemination, training and capacity building amongst land managers;
- The role of innovation in fostering sustainable land management needs to be encouraged to allow any increases in agricultural production to be carried out in a sustainable way, taking account of the needs of biodiversity and the provision of the full range of ecosystem services;
- Investment is needed in supporting the development of institutional capacity in Member States so as to make intervention as effective as possible;
- The value of biodiversity and related ecosystem services needs to be increasingly recognised and explored as an asset rather than a constraint on economic development; and
- The implementation of existing mechanisms, such as Strategic Environmental Assessment, Environmental Impact Assessment and other safeguards, need to be improved to ensure that biodiversity is taken into account when other environmental or economic objectives are being pursued.

The sections that follow consider some of the ways in which developments in policy can help to address these issues in the future. Focussing initially on the CAP, the chapter considers some of the principles underpinning policy design, the value of different types of approach for biodiversity and ecosystem service delivery and how these might be used together in the most effective manner.

6.2 Developing an improved policy response for biodiversity through the CAP

The challenge for policy is to identify the key biodiversity requirements for different agricultural habitats according to local requirements as well as EU objectives and to deploy appropriate measures to maintain, enhance, restore or recreate associated species and habitats accordingly. To meet these priorities, a spectrum of measures is needed, from the highly specific to the broader brush. Different approaches will be suited to different circumstances and can be used alone or in combination to achieve the biodiversity outcomes required in different areas in the most effective and efficient way possible.

The nature and design of the policy measures (for example whether they are mandatory or voluntary, broad brush or tailored to specific needs, universally applied or targeted), whether requirements are annual or multi-annual as well as the way in which the measures are implemented on the ground will all affect the biodiversity outcomes achieved. In addition, many other non-agricultural factors and drivers intervene and can affect the eventual outcomes. Earlier chapters have demonstrated that, for the EU-27 as a whole, the current policy response is not yet ensuring biodiversity provision in the most effective way possible or at the spatial scale required. There are a variety of reasons for this, which involve the policy architecture at the EU level as well as other political, financial and institutional factors which affect implementation on the ground (see Chapter 4).

For many species and habitats specificity in policy design is important. The scientific literature demonstrates that in general, ensuring that the right sorts of management in the right combination and in the right location is important for the delivery of different aspects of biodiversity (see Chapter 4). This requires tailoring management prescriptions to the particular habitat and/or species and often in relation to the particular site as well as targeting measures to locations where the management practices are most likely to have an impact. Determining the precise ecological requirements for different habitats and species is not straightforward, made more difficult by the fact that these factors are dynamic and vary spatially and temporally, depending on a range of factors, including soil type, climate, weather patterns, whether or not species are migratory etc. This means that considerable flexibility is needed in terms of delivery to allow management to be adjusted according to local circumstances and even weather conditions. Significant research effort is being put into determining the ecological requirements for certain species and habitats in some parts of Europe and is essential to improve the design, tailoring and targeting of policy measures, especially targeted ones such as the agri-environment measure, to achieve the delivery of specific biodiversity outcomes.

Such high degrees of specificity in policy design are not needed in all situations, however. For large parts of Europe, for example where semi-natural species-rich habitats remain, the key priority for biodiversity is to maintain the existing management practices which have preserved these habitats and their associated species over the years. For these HNV farming systems, although it is important to understand the interactions between the agricultural management being undertaken and the biodiversity benefits achieved, the priority is to enable these farming systems to continue and remain economically viable within a set of relatively simple environmental parameters (for example related to stocking densities and inputs) rather than requiring adherence to a lengthy set of management prescriptions. Indeed, the literature suggests that one of the reasons for the high levels of biodiversity in these sorts of situations is the variation in management between different fields and holdings and that schemes based on detailed, often standardised prescriptions lead to a homogenisation and standardisation of management in the farmed landscape (Rodwell *et al,* 2003; Hubbard and Hubbard, 2008). Fairly simple requirements may also be appropriate in other situations too, for example maintaining landscape features or where the priority is to reduce the pressures of intensive agricultural practices, for example by introducing crop rotations, requiring green cover on soils over winter. Currently many of these types of management are either required under cross compliance GAEC standards or are supported through basic agri-environment schemes in some Member States. Some of these types of simple management are also identified as the new 'green' measures to receive payments under Pillar 1, as set out in the Commission's legislative proposals for the future CAP (European Commission, 2011i).

The relative merits of different approaches will vary depending on the type of agricultural habitat in question and the state of the biodiversity within it as well as broader agricultural dynamics. Both approaches can work separately or in combination, where universally applied simple measures provide a good foundation on which more targeted and tailored actions can build.

Decisions on whether or not to apply broad brush measures, more tailored/targeted measures or a combination of both will be based on political and financial considerations, including the co-financing implications and the administrative costs of administering such schemes, as well as the local biodiversity needs and the outcomes that it is possible to achieve. For all approaches, however, there are some common principles that need to be included within the policy architecture to ensure effective delivery for biodiversity. These are as follows:

- The existence of clear strategic objectives at the EU level that set out the key priorities for the policy (or policies) in question, providing a framework within which more detailed policy measures can be established and facilitating coherence between different elements of the policy;
- Requirements that such objectives are translated into meaningful actions at the national/regional level;
- Sufficient flexibility to allow Member States to use measures in the most appropriate combinations and at the appropriate scale, and design policy responses that are regionally specific to address the priorities and needs identified locally;
- Mechanisms to secure cumulative benefits over a period of years and allow longer term objectives, such as habitat restoration, to be achieved; and
- Meaningful monitoring and evaluation.

Many of these principles or characteristics are embedded already in current rural development policy (Council Regulation 1698/2005), although there are improvements that could be made within Pillar 2 to make it operate more effectively. However, these principles should also apply to measures whose objectives include the delivery of biodiversity, wherever they sit within the CAP policy architecture, including, to the extent that this is possible, Pillar 1.

6.2.1 Setting Clear Objectives

A critical starting point for the development and design of any policy is to identify its purpose and the outcomes that need to be achieved. Clear goals and objectives then can be set. Ensuring that these objectives are clearly articulated, consistent and complementary is important both at the strategic EU level (for example within the EU2020 strategy), at a territorial level where multiple policies may interact (for example through the proposed Common Strategic Framework) and at a sectoral level (for example for both Pillar 1 and Pillar 2 of the CAP). With clear objectives, more detailed measures can be developed with the causality between the activities to be supported and the outcomes required made explicit. Intervention logics for individual measures within a specific policy specify this chain of causality. These principles hold for broad brush measures, applied over a large area of the countryside as much as they do for those that are highly targeted and focussed.

The recent report by the European Court of Auditors (ECA) on agri-environment support in the EU reinforces the importance of setting clear objectives in order to be able to assess the success of policies in achieving their goals (European Court of Auditors, 2011a) and to demonstrate to civil society the benefits of the use of public money. In relation to the agri-environment measure, the ECA concluded that, despite some good examples in some Member States, the objectives of many of the selected group of agri-environment schemes that they examined continued to be insufficiently specific, and were not set within a defined time frame. As a consequence the objectives were deemed too vague to be used for assessing the extent to which they had been achieved (European Court of Auditors, 2011a).

At present, the strategic EU objectives for agricultural biodiversity are set out within the Community Strategic Guidelines for rural development (Commission Decision 2006/144/EC), focussing on the role of Pillar 2 measures for meeting biodiversity goals. These highlight that biodiversity is a key priority to be addressed by Member States through their Rural Development Programmes (RDPs). They 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. The measures available under axis 2 should be used to integrate these environmental objectives and contribute to the implementation of the agricultural and forestry Natura 2000 network, to the Göteborg commitment to reverse biodiversity decline by 2010…'

It is proposed that a Common Strategic Framework, an overarching set of strategic objectives, applicable to all EU funds which have shared responsibility with Member States, which includes the EAFRD, will be drawn up for the next multi-annual financial framework (MFF) so that the funds work within an integrated structure (European Commission, 2011j). This will be operationalised through the introduction of partnership contracts between the European Commission and the Member States which will set out the priorities for the relevant funds in keeping with the Europe 2020 strategy. This approach could offer significant opportunities for a more coordinated and integrated approach to biodiversity conservation in rural areas. To this end, Iit will be important to ensure that biodiversity objectives feature as a priority within the Common Strategic Framework (CSF) and related partnership contracts with Member States and that they reflect the targets set out in the EU Biodiversity Strategy as well as demonstrating how biodiversity objectives can be delivered alongside other environmental, social and economic priorities.

The measures subsequently identified within individual Rural Development Programmes to deliver these objectives would sit within this overarching framework. They could include a combination of, for example, land management payments offered through agri-environment measures, various forms of investment aid, complementary forms of forest management, advice and training and related technical assistance. In order to move towards such an objective led approach, the rationale for the utilisation of different measures would need to be well developed, the anticipated outcomes identified clearly and the the way in which results are monitored agreed and put in place at the outset (Hart *et al,* 2011b).

This sort of strategic approach is increasingly being used at national and regional level to prioritise the actions deployed to deliver different environmental priorities and to coordinate the use of different funding streams for these purposes. The development of River Basic Management Plans (RBMPs) in relation to the Water Framework Directive is a good example of this.

This approach is being promoted also for biodiversity, particularly in relation to coordinating the actions required and associated financing in Natura 2000 areas, through the establishment of Prioritised Action Frameworks (PAFs)[42]. The aim of a PAF would be to set out objectives and priorities for Natura 2000 sites over a set period of time (for example the duration of the programming period). It would outline systematically the measures to be used and identify how these would be financed. A well constructed and presented PAF should help to improve and clarify stakeholder understanding of which measures and public funds are available and most appropriate for different Natura 2000 management activities (Kettunen *et al,* 2011).

The rural development Pillar of the CAP fits within the CSF framework quite readily. The current proposals for future CAP reform highlight the ambition to 'green' the CAP as a whole, and to integrate environmental, including biodiversity, goals also within Pillar 1 through the introduction of universally applied, annual, non-programmed environmental measures. If the proposed 'greening' options are agreed as part of the CAP reform negotiations, then increasingly a systematic combination of both Pillar 1 and Pillar 2 measures will be required to meet biodiversity objectives through the CAP. The goals and objectives set through the CSF should not be isolated from those outcomes that are intended to be delivered through Pillar 1, as one will need to build on the other.

6.2.2 Regional discretion and tailoring

As emphasised previously, Member States need some flexibility in designing programmes of measures that meet the priorities identified within their own territories and are best suited to local situations, while also meeting EU objectives. Even for most broad brush measures, that are applicable to most farms, evidence suggests that some degree of regional flexibility in the choice of measures to be implemented or in measure design has the potential to improve effectiveness. For example, the findings of a recent exercise to model the likely

[42] Article 8 of the Habitats Directive already foresees the need to develop a prioritised action framework (PAF) when sites are designated as Special Areas of Conservation

biodiversity outcomes of the Commission's greening proposals for Pillar 1, highlights that it may be more effective to promote different options in different regions in order to address specific environmental needs, concluding that 'a regionally differentiated policy may be more appropriate than a one-size-fits-all approach (PBL, 2011). The benefits of targeting discussed in the section below apply particularly to biodiversity.

However, there are trade-offs to be made between locally targeted and tailored measures developed within a regional framework, in which considerable discretion is available to the relevant authorities and relatively simple management requirements that can be universally applied in all 27 Member States. Administrative effort needs to be weighed against the quality of outcome and level of biodiversity delivered. This choice is evident in relation to the Commission's proposals for introducing mandatory green measures within Pillar 1. In principle, providing Member States with the flexibility to design important aspects of the different options to suit the conditions in their territory usually is desirable for reasons rehearsed above. However, it also introduces certain hazards, including the risk that Member States could take a minimalist approach to implementation. However, conversely, taking a more rigid set of EU-wide prescriptions inevitably limits the nature of the options that can be implemented. Not only must options be available to nearly all farmers in all farming types as equitably as possible within the EU, but also the data on which implementation and control are based have to be available on all farms where remote sensing is not possible.

To enable Member States to use measures in a flexible manner to deliver the strategic objectives for biodiversity, as set out in the EU Biodiversity Strategy and translated into the Community Strategic Guidelines (or the Common Strategic Framework in future), the structure of the relevant legislation (currently the EAFRD) needs to be designed in a way that facilitates the use of all relevant measures in creative and integrated ways.

Under the current structure, where the EAFRD is divided into four axes, measures which have the environment as their primary objective sit within Axis 2. However, as highlighted in Chapter 3, and as identified by a number of other studies, in reality there are range of measures from other Axes that have the potential to deliver biodiversity benefits, even though this may not be their main objective (see for example Cooper *et al,* 2009; ENRD, 2010). While in theory this need not necessarily be a problem, in reality this raises a number of issues. Firstly, packaging measures in different axes appears to have constrained creativity in using measures from different Axes in combination, despite the fact that this would be feasible technically. This seems to be due to the nature of the financial requirements under EAFRD, which impose a minimum proportional spend on each Axis. Combining measures from different Axes to design schemes at the country/regional level therefore can complicate financial reporting. Secondly, the structure of the legislation is reflected in the structure and nature of the monitoring requirements under the Common Monitoring and Evaluation Framework (CMEF). Under this framework indicators have been developed to measure the outputs of each measure, solely according to its primary objective, which in turn must relate to the overall objective(s) of the Axis, rather than reflecting the full range of outcomes which may occur.

The Commission's proposals to restructure the measures within EAFRD around a series of priorities and objectives rather than Axes in the future should help to increase the scope and incentive for Member States to address these priorities as creatively as possible and to use packages of measures to deliver the needs identified within their programmes (European Commission, 2011k). If this is to benefit biodiversity and ensure that it is delivered as a strategic priority in all regions of the EU-27, then biodiversity will need to feature clearly as one of the key priorities within any revised EAFRD, as the Commission proposes. If this is the case , the revised structure could lead to an increase in transparency in the way in which Member States design their RDPs and propose to use measures to deliver biodiversity as all RDPs would need to set out the biodiversity objectives and targets that they intend to address and the full range of different measures and actions that they intend to use to deliver these. If the relationship between the action supported by the proposed measure and the desired biodiversity outcome is clear, then this should in theory also lead through to increased transparency and clarity in terms of monitoring and evaluation - as long as indicators can be identified, and that adequate data and expertise is available and accessible to measure progress.

In assessing the robustness of a strategy based on regional discretion rather than generalised EU rules, the issue of institutional capacity must be considered. The EAFRD framework creates the conditions within which regional administrations and then local land managers operate. However, their success will only be secured if the framework is applied in the most appropriate way to deliver the priorities identified locally. It is clear from Chapter 4, that the right institutional conditions, institutional capacity and commitment are essential if the EU policy framework is to deliver real benefits on the ground. Issues of institutional capacity affect all aspects of policy implementation concerning biodiversity, from the transposition of EU Directives into national legislation and their subsequent timely and effective implementation, to the design of effective voluntary incentive measures under the CAP, through to the availability of investment aid, advice and training for land managers and their subsequent monitoring and evaluation.

This means that all efforts to improve the strategic framework at the EU level have to be accompanied by parallel development of regional capacity and in improving the knowledge base within Member States. The Commission has an important role to play in supporting progressive institutional development over time, including through the role they play in approving rural development programmes. The European Network for Rural Development could also be used on an expanded scale for this purpose. It can provide a platform for sharing experiences between Member States and regions and providing support and guidance where this is appropriate and needed, so that the relevant administrations are suitably equipped to adapt and improve their policies to deliver improved outcomes for biodiversity over time.

6.2.3 Appropriate measure/scheme design and implementation

As demonstrated in Chapter 3, effective policy design and subsequent implementation, control and enforcement, whether of regulation, mandatory or voluntary payments, is fundamental to achieving the outcomes required. This is also highlighted in Chapter 4 as a key determinant affecting the success of a policy measure.

As noted above, the ability to tailor schemes to local situations is important for achieving optimum biodiversity outcomes. In some cases highly targeted policy measures are needed that are focussed at the specific management needs of a particular species or habitat in a specific location, whereas in others a few simple requirements applying across the whole farmed landscape are needed. Whereas it is particularly important to address land management through appropriate incentives and mandatory requirements, a complete strategy also needs to address the underlying viability of the farming systems and structures concerned, particularly where there is a strong links to biodiversity provision. Hence within the scope of a strategic approach to biodiversity delivery through agriculture, there is a need to include such measures. There is scope also for measures that build on biodiversity as an economic asset, and encouraging collaborative actions at the landscape scale, such as for examples adding value to and encouraging the marketing of biodiversity-friendly products, promoting diversification and tourism activities and developing producer groups.

Given continuing declines in biodiversity in almost all of Europe, one of the critical issues to address is how to secure a certain level of environmental management across the majority of agricultural land in the EU-27, in both highly productive and more extensive farming systems. Although nuanced policy responses are needed to reflect and address the range of specific challenges described in this report, securing the changes needed at the scale required is difficult – although not impossible – to achieve through voluntary measures alone. Instead, some degree of compulsion may be needed if high uptake is to be assured (Hart *et al,* 2011b).

Currently, the principal EU mandatory measures in place for biodiversity on farmland are those stipulated through the Birds and Habitats directives. In addition, for those farmers that wish to receive direct payments from the CAP, there are a number of biodiversity relevant GAEC standards under cross compliance that Member States must apply in their territories and that must be carried out at the farmer's own cost. The main focus of the current policy approach to delivering biodiversity objectives on farmland, however, is through the voluntary approach, embodied through agri-environmental and other measures in rural development policy, but also involving to a much lesser extent other support measures, such as the LIFE+ programme.

One of the key benefits of agri-environment measures is that they require a sustained commitment to appropriate management over a period of years. For many biodiversity objectives, rather little can be achieved by very short term measures. Often it is necessary for the relevant management actions to be carried out over a significant period of time for the benefits to be realised. Multi-annual commitments allow for continuity of management over a period of usually five to seven years, and sometimes longer. The contractual nature of the agreement is also important, as it clearly sets out the requirements and also ensures a sustained commitment by the farmer who has certainty of receiving the corresponding payment upon compliance. Well specified agreements provide clarity and transparency to both the land manager and others about the purpose of the undertaking and the way in which public money is being spent.

Implementation of the agri-environment measure consists primarily of two types of scheme. One contains relatively simple prescriptions, with which most farmers can comply. Typically these are available over large areas of the farmed countryside. Such measures predominate in the agri-environment schemes of many regions. A second group consists of more specific and generally more demanding requirements, aimed at a smaller number of farmers requiring more targeted management focussed on achieving specific targets (European Court of Auditors, 2011a). Given the sophistication of many biodiversity objectives, good design is crucial to ensure that differing local conditions and priorities are reflected within the measures (Alliance Environnement, 2007a; Nitsch and Osterburg, 2007; European Court of Auditors, 2008; Boccaccio *et al,* 2009).While uptake of more broad brush measures, particularly for the maintenance of extensive grazing practices generally is high, experience shows that this usually is less so for schemes aimed at intensive farming systems. In these situations, the prescriptions tend to be less compatible with profit maximisation and take up often tends to be concentrated on those agri-environment options that require least additional effort or cause least disruption to the business. Uptake of more demanding measures in more intensively farmed areas generally has not made a sufficient impact on management to reverse the declines in farmland biodiversity.

Impediments to better design have been elaborated in Chapter 4 and relate to political, financial and administrative considerations as well as issues of institutional capacity.

Notwithstanding the significant improvements that continue to be made to the design and implementation of existing agri-environment schemes in many Member States and the scope to go further, there is a limit to what can be achieved if expenditure on such measures is not increased substantially, implying larger commitments from both the CAP and Member States. Given the current economic situation facing Europe, this may be difficult to secure. The European Commission's proposals for the 2014-2020 CAP, therefore, seek to improve the environmental performance of the CAP through 'greening' Pillar 1, by introducing a payment for carrying out environmental and climate management actions, which are compulsory for farmers receiving the basic direct income support payment.

This approach has significant policy backing. A joint letter from the Commissioners for Agriculture, the Environment and Climate in March 2011, stressed that 'the greening component of direct payments is … particularly important given the broad territorial nature of the measures. These actions would be mandatory … to all beneficiaries of direct payments and, thus, have a wide application across the EU territory. The environmental as well as climate related benefits associated with the measures under consideration … are very considerable, especially given their broad territorial coverage. 'Greening' the 1st Pillar will also facilitate the introduction of more ambitious environmental measures in Rural Development….'. Despite the fact that the full details of the requirements are not established yet, others are less convinced that this potential will translate into a net increase in environmental benefit achieved from the CAP as a whole (BirdLife International, 2011a).

Identifying simple, one-size-fits-all management requirements that are suitable for implementing on a purely annual basis through Pillar 1, balancing different aspects of biodiversity alongside other environmental objectives is not straightforward, because of the context-specific nature of most ecological requirements. However, three measures have been proposed as part of the Commission's CAP proposals that could be implemented on this basis – ecological focus areas, maintenance of permanent grassland and crop diversity.

Amongst the proposals, the measure that perhaps has the most potential to deliver additional environmental benefit is the 'ecological focus area', which requires a proportion (currently seven per cent is proposed) of a farm's eligible hectares (excluding land under permanent grassland) to be allocated for ecological purposes, for example as landscape features, buffer strips or fallow land. This has the potential to provide benefits for biodiversity (such as for birds, mammals and invertebrates) as well as benefits for aquatic biodiversity as a result of reduced run off and pollution of water courses. This is evidenced from the monitoring of similar management undertaken within agri-environment schemes and under set-aside in the past. However, the actual magnitude of the benefits will depend on the precise requirements under this measure, which have not yet been determined and in particular where EFAs are located. Given the generalised nature of the measure, its potential benefits may not be maximised due to farmer preferences. This is because the provision of in-field habitats such as fallow land, that is beneficial for important aspects of biodiversity, is currently undersupplied and experience from agri-environment schemes indicates that areas such as field boundaries and margins are likely to be most popular with farmers. The benefits for biodiversity could therefore be increased significantly by targeting and appropriate tailoring of management practices on the land concerned. This could be achieved by tying it in to more sophisticated management options supported by agri-environment schemes.

The measure requiring permanent grassland to be maintained at the farm level also should deliver some biodiversity benefits, although the measure focuses only on maintaining grassland area rather than protecting or enhancing its ecological quality. The most widespread impacts are likely to be in terms of constraining the conversion of improved grasslands to temporary grasslands and arable crops (such as maize), with benefits for soil condition and biodiversity, and knock-on benefits higher up the food chain, as well as for aquatic biodiversity. The conversion of semi-natural grasslands, which are of particularly high biodiversity value, to temporary grassland or arable would also be constrained. However, the risks such habitats face from agricultural improvement or abandonment will not be addressed by this measure, so this will continue to need to be dealt with via agri-environment schemes. In addition, the measure's biodiversity impact will be limited if the ploughing and reseeding of such grasslands is allowed as long as they are returned to grass, although the extent to which this occurs in practice varies significantly in the EU-27. Furthermore, the setting of 2014 as the reference year for the area of permanent grassland to be maintained may provide an incentive for the ploughing up of permanent grassland in the interim where opportunities for an alternative land use exist which could lead to significant ecological damage as well as soil carbon losses. Any cropped land, of course, would then be subject to an EFA. This risk is recognised by the Commission, who has proposed to extend the current national permanent pasture cross compliance requirement for a few years as a transitional measure in order to constrain the potential effect.

Introducing a minimum level of diversity into cropping patterns, as proposed by crop diversification measure, has the potential to bring modest benefits for biodiversity, particularly if it encourages greater rotation of crops, including the introduction of fallow or legumes into the rotation. Benefits for biodiversity will largely be in relation to common and widespread species, due to improvements in soil biodiversity and overall invertebrate populations, whereas the most seriously declining species are unlikely to benefit significantly. As with all these measures, impacts will be context specific

However, the 'greening' measures should not be seen in isolation. They should provide a foundation on which more focussed agri-environment schemes under Pillar 2 can build. By funding these basic measures through Pillar 1, a greater proportion of the current agri-environment budget should in principle be available to incentivise more tailored and targeted management activities and to increase the extent of their coverage. The 'greening' measures, in contrast would reach a much larger proportion of farms, particularly those in sectors where the attractiveness of the payment levels for agri-environment schemes has been a limiting factor, for example in arable areas, thereby also potentially increasing the attractiveness of agri-environment measures that enhance beneficial management on ecological focus areas.

In summary therefore the proposed new Pillar 1 'greening' measures could in principle:

- provide a strong and effective environmental baseline for all CAP support provided to land managers;
- increase uptake of basic environmental management across the majority of the farmed landscape both to support farmers who are already managing their land in environmentally beneficial ways and to incentivise others to adopt more sustainable farming methods; and
- provide a solid foundation on which more demanding agri-environment schemes under Pillar 2 can build;
- possibly release more funding for targeted Pillar 2 measures by incorporating certain elements of current Pillar 2 measures and related expenditure in Pillar 1.

A combination of broader bush and more targeted measures is needed for an effective strategy. Within such a broad architecture there is a need to develop innovative approaches as well as well tried measures. Examples include initiatives that involve groups of farmers, landscape scale implementation, for example to promote the restoration of ecosystems. Appropriate measures in Pillar 1 may be able to provide a foundation for more collaborative approaches to delivering biodiversity at a larger scale within Pillar 2, which will be important to help biodiversity adapt to climate change and continue to deliver the range of associated ecosystem services. There are several promising measures for applied research and innovation, particularly in relation to finding means of increasing food and energy supplies that are environmentally sustainable and do not deplete the biodiversity resource on which they ultimately depend. The proposed 'European Innovation Partnership for Agricultural Productivity and Sustainability' has this goal at its centre and it is to be hoped that this ethos is carried through into its subsequent application at the Member State or regional level.

6.2.4 *The role of monitoring and evaluation*

Monitoring and evaluation plays an important role in the development of effective and efficient policy instruments. It plays two important, but quite distinct roles. Firstly it is important for policy learning, to provide lessons on how well the programme is working and identify scope and ideas for improvement. Secondly it is essential for audit and accountability, to demonstrate to the funding authorities, taxpayers, stakeholders and the public what the policy is achieving (or not). This is particularly the case for biodiversity because the objectives and chains of causality are often relatively complex, the risks of unexpected results and perverse outcomes relatively greater, unplanned factors (such as severe weather events, unpredictable changes in species populations, actions in third countries affecting migratory species) are more likely, impacts often take time to emerge and outcomes may not be readily detected by untrained observers.

Although, within the CAP, frameworks for monitoring and evaluation are currently primarily associated with Pillar 2 (see Box 36), monitoring and evaluation is also critical to assess the effectiveness and efficiency, and therefore value for money, of all public expenditure, and therefore should be a central component within all elements of agricultural policy, including direct payments and cross compliance.

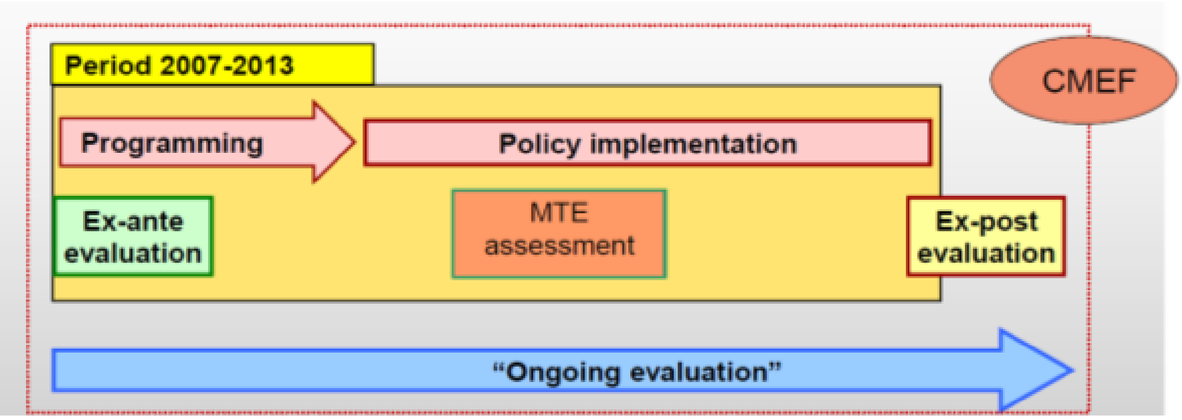
Box 36: The current monitoring and evaluation framework for rural development policy

Under rural development policy, there are two core strands to monitoring and evaluation. Firstly, the Common Monitoring and Evaluation Framework (CMEF) provides a standard framework for collecting consistent data on the implementation of Pillar 2 measures in different regions in Europe, based on a series of indicators, currently designed to measure outputs, results and impacts. Data from the measurement of these parameters is used to inform the mid-term and ex-post evaluations. Secondly there is an ongoing process of evaluation required throughout the lifetime of a rural development programme that looks at programme implementation and the results and impacts achieved. This consists of:

- **Ex ante evaluation** – whose purpose is to gather information and to carry out analyses which help to ensure that the policy objectives will be delivered successfully, that the measures used are cost effective and that reliable evaluation will be subsequently possible
- **Mid Term Evaluation** – to assess the way in which EAFRD resources have been programmed and the results and impacts of RDP interventions against programme strategies and in achieving Community priorities. It also considers the relevance and efficiency of the programme and its implementation and the factors contributing to success or failure. The findings should help to improve the quality and effectiveness of programmes and their implementation and inform the development of programmes in the next financial period.
- **Ex post evaluation** – assesses the results and impacts of the implementation of the programme over the whole seven year period. As with the mid term evaluation, the relevance and efficiency of the programme and its implementation and factors contributing to the success or failure are elaborated. The timing of this evaluation means that findings are used to inform amendments to subsequent RDPs, which will have been approved and operational before the ex post evaluation has been carried out.

The introduction of the CMEF and these periodic evaluations over the lifetime of the programme has strengthened the evaluation culture for rural development policy considerably. A clear common framework that applies to all Member States is particularly valuable in this regard. The monitoring and evaluation process is set out in Figure 4.

Figure 4: Evaluation process for Pillar 2 of the CAP – 2007-2013 programming period



Source: Maier, 2011

However, it should be recognised that the requirements of the CMEF are relatively challenging and different Member States are at different stages of development in relation to their experience with evaluation techniques. The approaches and issues encountered vary, influenced by differences in rural needs, political priorities, length of experience, levels of expertise, and institutional capacity. Some of the issues that have been experienced with the use of the CMEF that are relevant to biodiversity include the following (Evaluation Expert Network, 2010; Burrell, 2011; LUPG, 2011):

- There is an over-emphasis on metrics and insufficient account is taken of processes and other effects than can only be assessed using qualitative techniques, which can distract from a fuller appreciation of qualitative effects and value for money;
- There is a need for indicators that draw out the counter-factual, and distinguish between the additionality of the intervention and deadweight of other influences;
- The current set of indicators is not always appropriate for measures in some RDPs, and improvements are required to take account of the impacts of packages of measure or synergies, conflicts and side-effects of measures with one another – this is particularly relevant to biodiversity; and
- There needs to be more emphasis on ensuring that the indicators within the CMEF can be used to demonstrate the achievements of policies more clearly, both within the policy community and to civil society more widely.

To develop the current system so as to improve its capacity to provide information that enables a better understanding of the biodiversity benefits of support provided, there needs to be a focus on identifying what data would be most meaningful to inform policy learning and development. The current suite of output, result and impact indicators all have their role to play in providing a picture of the effects of policy. However, the success of these indicators, particularly the result and impact indicators, will depend on the degree to which the policy measures themselves have been well designed, with clear causality set out between the measure and the outcome required.

Two of the current impact indicators are focussed on biodiversity (farmland birds and the maintenance of High Nature Value farming and forestry). However, it is as yet too early in the programming period to determine progress in relation to these two important indicators. Possible additional impact indicators are being assessed, for example in relation to populations of butterflies associated with farmland. Improvements are also desirable to the current result indicator for biodiversity: 'the agricultural area under successful management for biodiversity'. At present this is measured by amalgamating the 'area under agreement' of a group of Axis 2 measures (agri-environment, Natura 2000, LFA) with no evidence that the effectiveness of such management for biodiversity has been taken into account (European Court of Auditors, 2011a). More emphasis on identifying what constitutes successful management for biodiversity is critical here. However, finding means of measuring successful management or biodiversity impacts is not straightforward. Some Member States struggle with the measurement of impact indicators for a range of reasons. Three of the most significant are: a) the difficulty of identifying the counterfactual situation; b) issues of data availability; and c) the lack of financial and staff resources to measure scheme outcomes in the detail which is required (Höjgard and Rabinowicz, 2011; Pražan, 2011b; Van Zeebroeck and Van Gijseghem, 2011). However, progress is being made and must be sustained if the commitment to meet biodiversity targets and deliver public goods more generally is to be maintained. At times of economic pressure, such as those experienced in Europe currently, there is even more of a need to demonstrate the beneficial impacts of public support.

In relation to biodiversity specifically, a sharper focus on the impacts of individual measures is needed. It is not only important to understand how rural development measures as a whole are delivering for biodiversity, but also what the relative contribution of different measures and, even more importantly, the different actions within measures have been, taking into account the influence that other external drivers and intervening factors may play. This is often difficult, given that incentives for land management, capital investment as well as advice and training will deliver more than just biodiversity. However, evidence from a range of Member States shows that, with significant investment in monitoring programmes, these sorts of detailed results are possible.

In terms of more detailed evidence on the effectiveness of policy measures in delivering specific biodiversity outcomes, the large body of scientific literature is helpful in providing data on specific habitats and species and in relation to specific locations. This provides useful context specific information. Although it cannot necessarily be generalised, this sort of evidence is essential to elaborate and complement patterns emerging from the formal evaluation data.

6.3 Achieving biodiversity goals alongside other EU strategic policy priorities

The CAP is the main EU policy instrument for delivering biodiversity through agriculture and this is unlikely to change in the foreseeable future. However, as shown in Chapter 5, the achievement of biodiversity goals associated with agriculture cannot be seen in isolation from broader trends in sustainability and sensitivity to biodiversity concerns in rural areas more generally. Some of these conditions are set by factors outside policy altogether or by local policies, such as land use planning. Others are influenced by national and EU policy frameworks, which can impact on farmland and rural biodiversity, even if this is not their prime objective. Achieving biodiversity goals through the CAP may become more difficult or more costly if other policy processes are pulling in different directions and the value of biodiversity to society is not fully recognised.

In relation to agricultural land use and biodiversity, a key issue is the increased competition for land for different purposes. Drivers and pressures come from a range of sources, including the need for additional food to feed a rising global population, anticipated to be nine billion by 2050, changes in dietary preferences, increased demand for bioenergy and biomass, changes in climate and the scarcity of some finite resources. This increasing competition for land to meet economically productive needs risks putting even further pressure on the delivery of environmental services, including biodiversity. This results in continued pressures on biodiversity, despite the increasing recognition of its role in delivering important ecosystem services and the economic value of such services (TEEB, 2011). Addressing this challenge is made all the more difficult, when set within the context of the current economic crisis facing many countries in Europe and globally.

The broad approach to achieving biodiversity as well as other environmental goals in the EU, has been to integrate biodiversity goals into those of existing EU funds or instruments, with the intention of embedding the delivery of biodiversity into several policy sectors. This principle is made clear in the overall objectives and targets set out in the recent Biodiversity Strategy. However, this approach relies on all relevant EU policies, both sectoral and thematic, to take adequate account of biodiversity issues, both by looking for ways of maximising synergies, as well as making sure that sufficient safeguards are put in place to prevent net biodiversity losses. This integrated approach, sometimes referred to as 'mainstreaming' in principle allows benefits for biodiversity to be achieved alongside other sectoral policy objectives and can drive genuine sectoral transformations towards sustainability if properly implemented (Medarova-Bergstrom *et al,* 2011). However, achieving consistency between the objectives of specific policies, funding instruments and EU objectives and meeting multiple demands in a sustainable way raises a range of challenges.

Biodiversity does not feature strongly within the EU2020 strategy (European Commission, 2010b), although it is mentioned in relation to the objective of sustainable growth, which states that 'such an approach will help the EU to prosper in a low-carbon, resource constrained world while preventing environmental degradation, biodiversity loss and unsustainable use of natural resources'. However, the recently published Roadmap for a Resource Efficient Europe (European Commission, 2011l), gives considerable emphasis to biodiversity, placing biodiversity and ecosystem services at the heart of the vision for 2050 (see Box 37). It stresses the challenges facing a transformation to a resource-efficient economy, but that this 'requires policies that recognise the interdependencies between the economy, wellbeing and natural capital and seeks to remove barriers to improved resource efficiency, whilst providing a fair, flexible, predictable and coherent basis for business to operate' (European Commission, 2011l). These principles are already included to some degree within the CAP and the proposals for its future development to embed them still further.

Box 37: Vision of the Roadmap for a Resource Efficient Europe

'The Vision: By 2050 the EU's economy has grown in a way that respects resource constraints and planetary boundaries, thus contributing to global economic transformation. Our economy is competitive, inclusive and provides a high standard of living with much lower environmental impacts. All resources are sustainably managed, from raw materials to energy, water, air, land and soil. Climate change milestones have been reached, while ***biodiversity and the ecosystem services it underpins have been protected, valued and substantially restored.*** **[own emphasis]**

Source: European Commission, 2011l

Changes in approach will be needed at all levels if this vision is to be achieved. For example, the refusal of Member States to commit to meeting the Biodiversity Strategy's sub-targets or to be held to account over introducing Biodiversity Action Plans, only serves to strengthen this. Perhaps one of the reasons for this is that, despite the growing body of evidence that demonstrates the value of biodiversity and ecosystem services as a capital asset, biodiversity concerns are mainly considered in terms of putting constraints on competitiveness. This has been highlighted in a number of the case studies, particularly those in the new Member States. Biodiversity's value as a capital asset can be illustrated by the ways in which biodiversity is used as a basis for enhancing income and generating jobs, such as through tourism, adding value to products based on their environmental credentials etc as well as the fact that achieving food security in the long term will require a sustainable resource base, which will depend upon the continued provision of ecosystem services. The recognition of the importance of biodiversity as an economic asset has been highlighted through studies such as The Economics of Ecosystems and Biodiversity (TEEB) and this now needs to be reflected more strongly than is currently the case in public policies affecting the countryside.

Within the agriculture sector, one of the challenges for policy will be to address the longer term implications of improving biodiversity delivery through appropriate farming systems and practices, alongside the need for Europe to continue to provide its share of global food supplies. For example, questions arise as to the balance between maintaining the current area of extensively managed agricultural land in Europe in order to protect some of the EU's most valued habitats and species, and the need to increase yields over time and probably in the process intensify production. In this equation the implications for production patterns, land use and biodiversity protection in other parts of the world will have to be taken into account.

There is a range of policy issues that this raises in relation to biodiversity. Firstly there is a clear need to address the need to improve biodiversity delivery in agriculturally improved habitats in all farming systems, at the same time as ensuring the continued management of extensive farming systems and restoring degraded habitats. Research and development and innovation policy will have a particularly important role to play in developing new production processes, management practices and technologies to meet the challenges of increasing agricultural productivity at the same time as meeting the EU's biodiversity targets.

Within the CAP, therefore, meeting biodiversity conservation objectives and delivering ecosystem services needs to be advanced in synergy with other goals, such as the promotion of a competitive agri-food sector and balanced territorial development, as well as other environmental objectives relating to climate and resource efficiency, as set out in the Commission's November 2010 Communication on CAP 2020 (European Commission, 2010i). This should be possible in theory, as biodiversity related measures can play a role in the long-term security of food supply, in underpinning rural jobs, in contributing to farm incomes and the development of rural and regional economies. The proposed European Innovation Partnership for agriculture, as highlighted in the Commission's Communication on an 'Innovation Union' and developed within the EAFRD legislative proposals (European Commission, 2011k) would help to catalyse the fostering, sharing and developing innovative approaches to sustainable land management. However, in practice, tensions and conflicts can arise, particularly in relation to biodiversity provision and short-term agricultural competitiveness and will need to be addressed. For example, if global food markets remain tight and the gap between input and output prices continues to widen, additional incentives will be required to encourage farmers to enter voluntary biodiversity related schemes (Hart *et al,* 2011a).

Secondly, sensitive issues in relation to the use of land for biofuels and the deployment of new technologies will have to be addressed. Harmonising policies for biodiversity with those for renewable energy production is likely to become a more critical issue as supply levels increase, with significant implications for agricultural land use. The CAP on its own cannot deliver the EU's ambitions for biodiversity in farmland unless the matrix of related policies and their implementation on the ground is also moving in broadly the same direction.

The CAP has the greatest potential of all EU policies to deliver biodiversity on farmland and its relationship with the Biodiversity Strategy is of key importance. Within the CAP, a set of complementary policies is required for an effective strategy, implemented through well designed measures and backed up by a sufficient budget. Both highly targeted and tailored policy approaches and broader support for appropriate land management will have a place, but need to be planned and delivered within a clear framework that pinpoints specific requirements at the Member State level. A reinforced monitoring and evaluation framework could help to progress policy in this direction, alongside a stronger emphasis on effective delivery on the ground.

7 CONCLUSIONS AND RECOMMENDATIONS

The term biodiversity encompasses the full spectrum of ecosystems and living organisms, including animals, plants, their habitats and their genes. It is affected by many current and historical factors - biophysical, ecological, climatic, economic and agronomic. Addressing biodiversity conservation through agriculture is therefore a complex undertaking. The importance of biodiversity is recognised increasingly at both the EU and global level, not just for its intrinsic and cultural value, but also for its fundamental role in the delivery of ecosystem services and hence for human well-being.

The management of agricultural land, covering almost 40 per cent of the land area of the EU-27, is critical for achieving the biodiversity conservation goals set out in the EU Biodiversity Strategy. Against evidence of continuing declines in farmland biodiversity and other species and habitats affected by agricultural management, this study has sought to consider the policy response through CAP and other policy measures up to the present, with a view to highlighting future policy needs.

This chapter sets out the main conclusions from the study and where appropriate highlights recommendations for the development of policy in the future to increase the contribution of agriculture in achieving the EU's 2020 biodiversity goals.

Maintaining and enhancing biodiversity through agriculture is important for species and habitats in protected areas and the wider European countryside, as well as for agriculture itself.

European farmland is dominated by a mix of semi-natural habitats (such as wooded pastures, shrublands, dry grasslands and meadows), agriculturally improved grasslands, cultivated croplands and permanent crops. In addition, some open natural habitats (such as blanket bogs and salt steppes) remain that are extensively grazed by livestock, but these are not normally dependent on agriculture for their existence. Avoiding agricultural impacts on these natural habitats is therefore a high priority. In contrast, livestock farming has played a significant role in creating and sustaining semi-natural habitats and the continuation of beneficial farming practices is often crucial for their survival. Semi-natural agricultural habitats are often species-rich and now relatively scarce, having been much reduced over the last 50 years. Consequently, many such habitats and their associated species are of Community interest (ie listed as such in the Birds and Habitats Directives). While relatively large proportions of semi-natural habitats now fall within Natura 2000 sites, significant areas also occur in the wider countryside outside protected areas and are dependent on the broad-scale maintenance of High Nature Value (HNV) farming systems.

Agriculturally improved habitats include highly productive farming systems (intensive croplands and temporary grasslands), extensively farmed croplands (such as dry cereal crops in parts of the Iberian peninsula), permanent crops (such as traditional orchards and olive groves) and organic systems. Considerable evidence indicates that the biodiversity conservation value of these habitats (that is, the diversity of characteristic species and rare species) declines with increasing agricultural improvement, specialisation, concentration and intensification. Habitats under intensive conventional systems support few invertebrates, plants, birds or other fauna of high conservation importance, compared with extensively farmed croplands and traditional permanent crops which have significantly contributed to sustaining Europe's most ecologically valued biodiversity. Nevertheless, all retain some widespread and adaptable species, amongst them birds, which are often the last visible vestiges of nature in many farmland landscapes and are particularly appreciated by the wider public.

In addition, biodiversity management supports the delivery of essential ecosystem services related to both farmland and the wider countryside (such as pollination, pest regulation, nutrient cycling, soil health and microclimate regulation) and thus sustains sustainable agricultural production. It also helps to sustain the rich genetic diversity of local breeds of farm animals and varieties of crops in some extensively farmed areas of Europe, many of them being adapted to the soils, vegetation and climate of their region.

Pressures facing biodiversity associated with agriculture are such that efforts to date have been insufficient to meet the biodiversity targets for 2010.

It is evident that on-going changes in agricultural systems and farming practices, continue to have significant biodiversity impacts. Member State monitoring data reveal that a particularly low proportion of natural and semi-natural agricultural habitats of Community interest have a favourable conservation status as defined by the Habitats Directive. Unless the condition of such habitats is improved, the aims of the Directive will not be met. In addition, monitoring data on birds and butterflies provides clear evidence of substantial declines in species populations and species richness, particularly in improved grasslands and highly productive cultivated croplands.. Such declines are now general across the EU, but have been greatest in the EU-15.

Pressures on biodiversity associated with EU agriculture are linked to the principal structural changes that have taken place, affecting farming practices and, in turn, species and habitats. These include specialisation, mechanisation, consolidation, the intensification of some farming systems and extensification of others. Under-management and abandonment of agricultural land affects semi-natural habitats in particular, because these habitats are most susceptible to marginalisation and depend on the continuation of traditional agricultural practices. Agricultural improvements that took place in the past in some semi-natural habitats through drainage, fertiliser use and the conversion of grasslands to arable or permanent crops also played a major role in the loss of biodiversity value. In addition, practices aimed at sustaining high productivity in most arable systems and permanent crops have increased external impacts on biodiversity, in particular the nutrient enrichment of sensitive ecosystems through air and water pollution. The impact of several of these practices is anticipated to continue to grow in the future because the intensification of grasslands and cereal crops is likely to continue on significant areas of farmland, alongside further concentration and specialisation of production, especially in the new Member States. Further pressure for the conversion of permanent pasture on more fertile soils to arable is likely in the future to meet the demand for both conventional and bioenergy crop production.

Given the continued pressures facing biodiversity, it is important that a basic level of protection is provided through EU directives, national legislation and standards of good practice to limit the impacts of these negative pressures. Where farmers apply practices favourable for biodiversity which go beyond this mandatory baseline to meet the demands of society, these actions usually need to be incentivised through public policy to ensure a reallocation of resources that provides the desired outcome for biodiversity. There is a range of management practices that can have beneficial impacts on biodiversity in all agricultural habitats and a range of policy instruments that can be used to promote these.

There is a considerable potential to support biodiversity in all agricultural habitats of the EU, with semi-natural grazed habitats meriting a special policy focus.

Agriculture has a considerable potential to sustain biodiversity, especially where traditional extensive semi-natural habitats remain, and the maintenance of such habitats should therefore be a special policy focus. This will require support for beneficial management practices (for example extensive grazing with appropriate livestock, haymaking, traditional pastoral woodland management), aimed at avoiding intensification or abandonment of these habitats. Because semi-natural habitats are diverse, and their management needs vary according to local circumstances, conservation management actions need to be designed specifically for these habitats and associated species.

With regard to agriculturally improved grasslands and intensively cultivated croplands, agriculture has significant potential to enhance the conditions for animals and plants through several types of management. In many situations the highest priority is to reduce external impacts on biodiversity (for example by creating buffer strips along water courses to reduce nutrient run-off, introducing precision farming and integrated production methods). On-farm biodiversity can be enhanced most efficiently by increasing habitat and food resources. In arable dominated landscapes in-field management options that target declining specialist species are of particular importance. Such measures have already proved to be effective for farmland birds in intensive arable systems (for example in the UK) and extensive dry cereal systems in the Iberian Peninsula. In landscapes dominated by improved grassland, reductions in the use of fertiliser, delayed grass-cutting, and actions that increase seed availability and crop diversity seem to be the most beneficial for biodiversity. Appropriate management and restoration of boundary features and field margins in all farmland habitats is also beneficial for some, mostly generalist, species.

Promoting habitat diversity at a landscape scale is also important for biodiversity. This can be achieved through mixed farming systems and the use of rotations in cropped areas, particularly rotations that incorporate fallow land. Such diversity is a valuable characteristic of many High Nature Value farmland systems, and therefore merits attention both in policy design and implementation. Maintaining unfarmed features (such as hedges, patches of scrub, trees, ditches and ponds) in different agricultural settings also contributes to forming complex structurally diverse farming landscapes and helps to maintain ecological connectivity in fragmented farmland landscapes. Alongside the provision of biodiversity benefits, unfarmed features can play an important role in meeting other environmental objectives, for example by reducing soil erosion and contributing to flood control.

A wide range of policy measures within and outside the CAP is in place to address biodiversity - within the CAP some are of key importance.

Maintaining, enhancing and restoring biodiversity has been one of the key priorities to be addressed by environmental measures within the CAP ever since they were introduced in the 1980s. The focus has been predominantly on measures that aim to influence land management practices through providing the right incentives to farmers. The agri-environment measure is the main measure directly focussed on the provision of biodiversity and continues to be the most significant both in terms of the financial resources allocated to it and its spatial coverage. It includes support for organic farming. Certain Pillar 1 measures also have biodiversity as an objective. These include elements of cross compliance, including some standards of Good Agriculture and Environmental Condition (GAEC) and the quantitative permanent pasture requirement at Member State level, as well as certain aspects of Article 68 specific support to agriculture.

However, a whole range of other CAP measures can also be used to deliver biodiversity, both within Pillar 1 and Pillar 2. They include obligations for Member States to set up a Farm Advisory System, other Pillar 2 land based area payments such as Natura2000 and Less Favoured Area (LFA) payments, as well as other Pillar 2 measures. There is scope to more fully mobilise these measures to sustain Europe's biodiversity. Several factors play a role in this regard. In some cases limitations on their use was due to constraints on rural development budgets and in others a lack of political commitment to using the measures available, or issues with programme design and implementation by the Member State or region, all of which have influenced the biodiversity outcomes achieved in practice.

EU legislation also plays an important role in the provision of farmland biodiversity, particularly the Birds and Habitats Directives and requirements set out under *inter alia* the Nitrates Directive and the EIA Directive. Environmental legislation provides the foundation on which other policy measures build, particularly biodiversity focussed measures within the CAP. Slow and incomplete implementation of environmental legislation has been shown to compromise significantly the effectiveness of the CAP measures, particularly in relation to the Habitats Directive (lack of management requirements articulated for many Natura 2000 sites; insufficient implementation of Article 10 on the maintenance of landscape features) and the EIA Directive.

The agri-environment measure has achieved considerable successes in maintaining and enhancing biodiversity on the ground, but its potential is still not fully used.

There are many examples of positive outcomes that have been achieved by agri-environment measures in both semi-natural and improved habitats for a range of habitats and species. These include, for example, the maintenance of species-rich habitats through support to management practices that have historically maintained HNV farming systems, (particularly in parts of southern and eastern Europe), and the conservation of some species of farmland birds, invertebrates (butterflies, bumblebees etc) as well as small mammals. Appropriate farmland management has restored degraded habitats and increased the populations of threatened species in several Member States. To maintain and restore farmland populations of more common and widespread species is often more of a challenge, due to the scale and cost of the response that is needed, but there have been some successes and recent initiatives are encouraging.

In other situations, evidence on the impacts and effectiveness of the agri-environment measure shows varied impacts on biodiversity. This state of play is not unexpected for a range of reasons, including:

- ecological constraints on the application and outcome of measures, such as habitat fragmentation, the impacts of external pressures such as air-borne nutrient pollution and climate change;
- the amount of funding made available for the key measures and its impact on the scale and type of measures that can be implemented, and consequently their capacity to counteract underlying economic trends that are pulling in the other direction;
- difficulties with designing schemes and specific measures in the face of incomplete knowledge of ecological requirements, for example relating to the type, scale and spatial distribution of management measures that are required to meet biodiversity maintenance and restoration objectives;
- some weaknesses in institutional conditions and capacity in different parts of Europe, which influence scheme uptake, implementation, monitoring and adaptive management; and
- farmers' attitudes, for example with respect to long-term interventions and new practices.

A well balanced combination of measures is essential for a successful strategy to achieve biodiversity outcomes.

The report highlights the importance of using combinations of measures to provide integrated packages of support to farmers. In particular, using the agri-environment measure in combination with other land-based area payments for delivering biodiversity outcomes is highlighted as essential in many situations. In some areas, the Natura 2000 payments and the Less Favoured Area (LFA) payments, have proved important in complementing agri-environment management and enhancing the effectiveness of measures for delivering biodiversity benefits within a broader sustainability perspective. In more remote areas with agricultural habitats of high biodiversity value, but where the economic viability of farming is under pressure, the use of the LFA measure in particular, but also the Natura 2000 measure, is reported to send an important message about the social value of farming in these areas and highlight a societal commitment to maintaining its economic viability. Well designed generic measures that help to maintain key forms of agricultural management and certain practices of widespread value over a sizeable area with relatively low transaction costs have the potential to complement more tailored and targeted measures; thereby efficiently delivering robust and coherent programmes of interventions that contribute to meeting biodiversity objectives.

In relation to the agri-environment measure, using the optimum combination of management options in the correct location is essential as well as devising well chosen options which individually deliver on the ground. Such combinations are important for the delivery of locally specific outcomes needed to meet the requirements of many species and habitats. This involves creating packages of management options tailored to the particular habitat or species (and often in relation to the particular site) and targeted to those areas or farming systems where interventions are most likely to have an impact. To be effective, therefore, it is critical to use research and piloting of agri-environment schemes to design packages of management options that meet the combined ecological needs of the targeted species and habitats.

More attention needs to be given to developing balanced programmes and packages of measures in the future. These need to combine agri-environment management with measures designed to secure the economic viability of farms and rural areas (for example, access to markets, diversification, creation of micro-enterprises, encouragement of rural tourism, and conservation of rural heritage) and measures to develop the skills and capacity of farmers.

Trends within wider rural economies can exert differing pressures on biodiversity.

The evidence from case studies in particular demonstrates that identifiable trends in rural economies and communities exert differing pressures on biodiversity. The degree to which anticipated policy synergies can be built upon as part of future trajectories for the development of rural areas will vary in different parts of the EU, depending on their agricultural and socio-economic characteristics. Areas which are lagging economically and where agriculture remains predominantly small scale and unmodernised, often suffer from remoteness and declining populations. They are of particular concern as they are often host to valuable semi-natural habitats, the maintenance of which is linked to the continuation of farming. In these areas there is particular pressure both for rural economies and the agricultural sector to develop and become more competitive in order to remain viable, or alternatively for land to become abandoned. Finding ways of achieving sustainable solutions for these areas is paramount. Supporting appropriate socio-economic development is just as important as pursuing environmental concerns in many cases. The Leader approach can be a very useful means to facilitate this.

In more economically vigorous rural regions, two types of area can be identified. Firstly there are those where specialised, consolidated and intensified agriculture predominates, and secondly those less affected by intensification and specialisation due to a diversity of income sources and business strategies. The latter frequently demonstrate high levels of pluriactivity, farm diversification, strong external economic linkages (for example with agro-tourism), local quality products, farm forestry, up and downstream industries, all with a potential to use biodiversity as an asset. The first type of areas are relatively competitive in economic terms because they produce for wider markets but often risk becoming disconnected from the rural community, losing certain locally adapted farming skills and having negative impacts on biodiversity and ecosystems. There is a further type of relatively modernised rural region that is supported by modern agriculture, but which is challenged by remoteness, declining rural structure, adverse population trends, and declining viability. New economic opportunities may help to sustain these communities and their farming systems (eg renewable energy, e-business, added-value product development, tourism and leisure) and these may be enhanced by new forms of payment for ecosystem services.

Biodiversity is recognised increasingly as providing economic benefits and development opportunities for rural areas, contributing to green growth.

In the past, biodiversity was often seen as a constraint to the economic development of rural areas. As a consequence, policies designed for economic growth in rural areas typically have not taken account of biodiversity. While conflicts between economic development and biodiversity conservation will undoubtedly remain in the future, there is growing scope to use the concept of biodiversity as an asset. Applied at the sub-regional territorial scale and to whole rural economies rather than just to the farm sector, such policies have the potential to identify sustainable development trajectories that explicitly valorise biodiversity, thus contributing to 'green growth'. This implies using a wide range of rural development policy measures, in well-considered combinations, to achieve biodiversity aims alongside the development of green infrastructure and delivery of ecosystem services, moving away from a more traditional notion of aligning only specific instruments with specific goals.

The occurrence of 'win-win' situations where biodiversity is supported by sustainable rural development requires some investment in human and social capital, in the form of informed environmental awareness, significant institutional capacity, as well as strong institutional links between those involved in the protection of natural assets and rural economic activity. It will be important to embed further sensitivity to biodiversity concerns within the implementation of all CAP policy measures in the future. However, tensions between economic development and the management of land aimed at maintaining and enhancing biodiversity are unlikely to be reconciled in the immediate future. Ensuring that the appropriate safeguards are developed and put in place to minimise any damaging effects is therefore equally important. This includes the need to implement existing assessment processes, such as Strategic Environmental Assessments and Environment Impact Assessments, effectively to ensure that expenditure from different public sources do not support activities that could lead to unacceptable loss of biodiversity.

The 'green growth' agenda may in turn offer a number of opportunities to biodiversity. For example the development of green technologies and methods in agriculture can have benefits for biodiversity (for biological waste treatment, pollution control, sustainable pest control and sustainable water management etc). In addition, there are opportunities relating to the creation of jobs and new development initiatives in environmental management and related activities that recognise and support the provision of ecosystem services to the wider economy and community.

A step change is needed to be able to meet the new 2020 biodiversity targets for agriculture, and this requires action on several different fronts, with the CAP being a key component.

The findings from this study point to the need for a step change in the delivery of biodiversity benefits through agriculture if the EU2020 biodiversity target is to be met. The challenges facing the CAP to deliver biodiversity goals are not small but there is considerable existing potential that can be mobilised to meet them. Delivering biodiversity and ecosystem services through agriculture cannot be seen in isolation from the delivery of other environmental, social or economic objectives, including the long term security of food supply and balanced territorial development. The increased competition for land for different purposes is a key issue that requires further consideration. However, it is important to recognise the increasing evidence of biodiversity's importance to human well-being and opportunities for win-win solutions , to ensure that the importance of protecting and enhancing biodiversity through policy is accepted as important not just for its intrinsic value, but as an important element of long term and sustainable economic growth.

However, given that biodiversity on farmland is in nearly all cases a public good, it cannot be delivered through the market and therefore policies are needed to ensure that it is delivered to the extent demanded by society. Given that significant issues of undersupply remain, sustained improvements in policy are needed to rectify this situation, both in terms of design and implementation. There needs to be a marked increase in the area of agricultural land subject to basic environmental management to ensure that biodiversity thrives in the wider countryside as well as in protected areas. This is required in order to protect the existing biodiversity resource within semi-natural habitats, to overcome the ecological constraints of habitat fragmentation and to improve the capacity of agriculturally improved habitats (arable, permanent crops and improved grassland) to deliver biodiversity benefits. In addition, far greater attention needs to be paid to designing schemes that address the needs of threatened habitats and species as well as those that are common and widespread. At the EU level the CAP will continue to play a central role as it is best equipped to influence land management and other rural development activities which hold the key to success in reversing the decline in biodiversity. However, improvements are also required to the implementation of EU legislation. To address these needs, six key areas of improvement have been identified.

Firstly, the legislative framework currently in place to protect Europe's most valued biodiversity needs to be implemented fully and effectively as well as adequately enforced. This is essential to provide the foundations of biodiversity maintenance and restoration, upon which improved management needed to protect biodiversity in particular locations (for example Natura 2000 sites). CAP measures thus should amplify and extend the core protection embodied in legislation, but can only do so if the relevant legislative requirements are put into force fully. For example, the absence of clearly identified management requirements for many Natura 2000 sites, inhibits the effectiveness of CAP measures in providing support to achieve favourable conservation status.

Secondly, biodiversity priorities that have been articulated at the EU level need to be more fully integrated into the CAP and translated into rural development programmes at the national and regional levels. The study has shown the value of articulating biodiversity objectives clearly at all levels of policy. This is important both at the strategic level of the EU (such as through the EU 2020 strategy, the biodiversity strategy and the resource efficiency roadmap), at a territorial level where multiple policies may interact (for example through the proposed Common Strategic Framework (CSF) and related Partnership Contracts) and at a sectoral level (for example for both Pillar 1 and Pillar 2 of the CAP). In terms of prioritising

EU spending on biodiversity, the forthcoming CSF for 2014 - 2020, setting out an overarching set of strategic objectives, applicable to all EU funding programmes, should offer significant opportunities for a more coordinated and integrated approach to maintaining and enhancing biodiversity in rural areas.

Thirdly, the funding of biodiversity measures through the CAP needs to be substantially increased if the EU's targets are to be met, alongside an appropriate contribution from other national and EU funding instruments, for example the LIFE+ programme. Given the importance of the agri-environment measure It will be particularly important to ensure that existing financial commitments to this measure is under Pillar 2 are maintained and preferably increased into the next programming period.

Fourthly, the design and implementation of policies within the CAP needs some improvement, particularly to ensure that issues with the eligibility of important farmed semi-natural habitats for CAP payments are resolved, that measures are used in ways that address concrete priorities and conditions, that payment levels are appropriate, that advice and support is adequate.

A mix of policy measures, some tailored closely to local conditions, others more widely applicable are required for a balanced approach which needs to be embedded in any future strategic framework for biodiversity associated with agriculture. In particular, the flexible use of policy measures in appropriate combinations to meet biodiversity needs alongside supporting relevant social and economic needs is essential.

Gaps in understanding of the type, scale and location of agricultural management requirements to provide the ecological needs of particular species need to be filled and investment made in novel approaches, such as encouraging landscape-scale participation by farmers in agri-environment schemes, which will be required on a larger scale than at present.

Another approach that has the potential to benefit biodiversity, particularly common and widespread species is embodied in the Commission's recent CAP reform proposals, proposing the introduction of generalised, annual payments for environmental and climate purposes into Pillar 1. Depending on how their final design and implementation, all three measures proposed (ecological focus areas, permanent grassland and crop diversity) have the potential to deliver some benefits for biodiversity, but the measure that perhaps has the most potential to deliver additional environmental benefit is the 'ecological focus area' (EFA). The magnitude of benefits will depend on the precise details of this measure, which are not yet clear. The benefits for biodiversity could be increased significantly by the targeting and appropriate tailoring of management practices on the land concerned, which in many cases might be achieved through the use of agri-environment agreements. It will be important to ensure that the details of the measures do not undermine their intended objectives. For example the use of 2014 as the reference year for the area of permanent grassland to be maintained could provide an incentive for the conversion of permanent grassland in the interim. This could counteract the positive benefits for biodiversity intended, although the extension of the current national level permanent pasture cross compliance requirement should help to reduce this risk.

In addition, increased emphasis needs to be given by implementing authorities to farm level advice, information dissemination, training and capacity building amongst land managers and agricultural extension services areas in EU funded technical assistance could help in this regard.

The role of innovation in fostering sustainable land management also needs to be encouraged to allow increases in production to be achieved sustainably, taking account of the needs of biodiversity and the provision of the full range of ecosystem services.

In relation to design and implementation, the study highlights the importance of putting adequate mechanisms in place to address trade-offs when implementing measures. This includes ensuring that the regulatory safeguards that are technically in place are adequately implemented and enforced, ensuring that expenditure from different public sources minimise risks of loss of biodiversity.

The fifth area of improvement concerns the policy and political commitment to achieving biodiversity goals and targets in relation to agriculture. This needs to be increased. The study has highlighted issues with institutional capacity and political will at the Member State level as a significant limiting factor. Considerable support needs to be provided to Member States, therefore, to help those responsible for the development and implementation of policies for biodiversity to understand the importance of biodiversity for the long term sustainability of land as a productive resource and as a means of underpinning the provision of a wide range of ecosystem services so that they can make the adaptations to policy needed over time and in changing circumstances. Encouraging policy experience and expertise to be developed and shared between Member States is also important and should lead to improvements in policy design and implementation over time.

Finally, the essential role of monitoring and evaluation in the development of effective and efficient policy instruments should not be underestimated. The current evaluation requirements under rural development policy have significantly advanced the evaluation culture both at the EU level and in Member States, but improvements can be made. These include revisions to the existing suite of CMEF indicators and encouragement of qualitative evaluations alongside the collation of quantitative data. The importance of detailed scientific research and evaluations in relation to biodiversity should not be underestimated and these need to be continued and sufficient resources invested in this area in all parts of the EU to complement formal evaluation requirements put in place by EU legislation.

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8 ANNEX 1 – CASE STUDIES

The empirical data that underpins this study was collected through six in-depth case studies. The case studies were conducted between March and May 2011 and comprised a review of the legislative and policy framework, an analysis of policy evaluations and indicators, qualitative interviews. This resulted in semi-quantitative and qualitative data on the range of biodiversity benefits provided through the CAP measures as a policy response in six Member States.

The six case study countries (Czech Republic, France, Germany, Greece, Romania, and the United Kingdom) were selected to capture a wide range of agricultural habitats, under varying geographic and environmental conditions, with a mix of old and new Member States (as set out in below Annex Table 1). The case study countries also vary in the extent to which they prioritise the delivery of biodiversity through agriculture over other policy objectives – environmental, economic and social, in the nature of the policy response and the measures used and in their eligibility for funding under convergence objective. They aim to be illustrative of the diversity of the bio-physical, climatic, agronomic and environmental conditions across the EU, different socio-economic situations and institutional capacities, and provide illustration of this diversity through specific examples of benefits delivered through the CAP measures.

Annex Table 1: Characteristics of the six case study areas

Case Study Area	Dominant farming systems (% of UAA – Except Livestock)				Agricultural ecosystem types	Agriculture as a proportion of GDP (%) (as of 2007)	Proportion of UAA by farm class size (%) (2007)*			Proportion of UAA in less favoured or mountainous area (%)	Proportion of farms in different ESU classes (%)			Where GNI is under 90% of EU27 average	GDP per inhabitant is less than 75% of EU average
	Arable	Permanent pasture and meadows	Permanent crops	Grazing livestock (% of all livestock)			Small (0-10 ha UAA)	Medium (10-50 ha UAA)	Large (over 50 ha UAA)		1 to 16 ESU	16 to 100 ESU	Over 100 ESU		
Czech Republic	73.5	25.4	1	52.3	Mixed, inc. significant semi-nat upland grassland	0.9	61.8	22.5	16.7	no data	70.9	19.4	9.8	YES	YES, 7 NUTS 2
France (mainland)	66.8	29.3	3.8	67.4	Very diverse, inc lowland and upland semi-nat habitats	1.5	33.9	28.7	37.4	44.3	33.5	49.5	16.9	NO	NO
Germany	70.4	28.3	1.1	54.3	Mostly highly modified / improved, but semi-nat montane habitats	0.6	36.4	40.6	23	49.3	46.3	40.9	12.7	NO	YES, 7 NUTS 2
Greece	50	20.3	54.5	78.2	Large areas of semi-nat, inc. important Med. habitats	2.8	90.1	9.4	0.5	71.2	87.1	12.7	0.3	YES	YES, 9 NUTS 2
UK	40.7	59.1	0.2	80.4	Mostly highly modified / improved lowlands, but extensive semi-nat uplands	0.4	49.6	25.7	24.7	43.5	52.6	33.7	13.7	NO	YES, 2 NUTS2
Romania	63.8	33.2	2.4	69.5	Large areas of semi-nat, in mountains and lowlands, and extesive arable	5.1	98.7	1	0.3	29.7	98.7	1	0.2	YES	YES, whole territory

Annex Figure 1: Map showing the location of the six case study countries

9 ANNEX 2 – INTERACTIONS BETWEEN BIODIVERSITY AND AGRICULTURE

9.1 Annex 2.1: The interrelationships between agricultural practices and biodiversity

9.1.1 Grazing

Grazing by livestock (and other large herbivores) has profound impacts on many agricultural habitats, especially semi-natural habitats, which are often of particularly high conservation importance (see Section 2.3). Grazing affects vegetation its composition and structure, and in turn invertebrates and other species that rely on the vegetation for food and shelter, and their predators and parasites. Furthermore, whilst climate principally determines grassland composition and structure at the regional scale, the effect of grazing is important at scales from that of the landscape down (Gibson, 2009). The interrelationship between grazing and biodiversity is therefore examined in some detail below.

Natural and semi-natural habitats

Grazing has a particularly significant impact on natural and semi-natural agricultural habitats, by shifting the competitive balance amongst species in the vegetation community. Impacts on individual plant species vary according to a number of factors, but of prime importance is each species' grazing resistance. This can be defined as a relative ability to survive and grow within a community subjected to grazing pressure (Briske, 1996). Grazing resistance is related to each plant's life history (Grime *et al,* 1988) and comprises two complementary strategies for withstanding grazing: avoidance and tolerance.

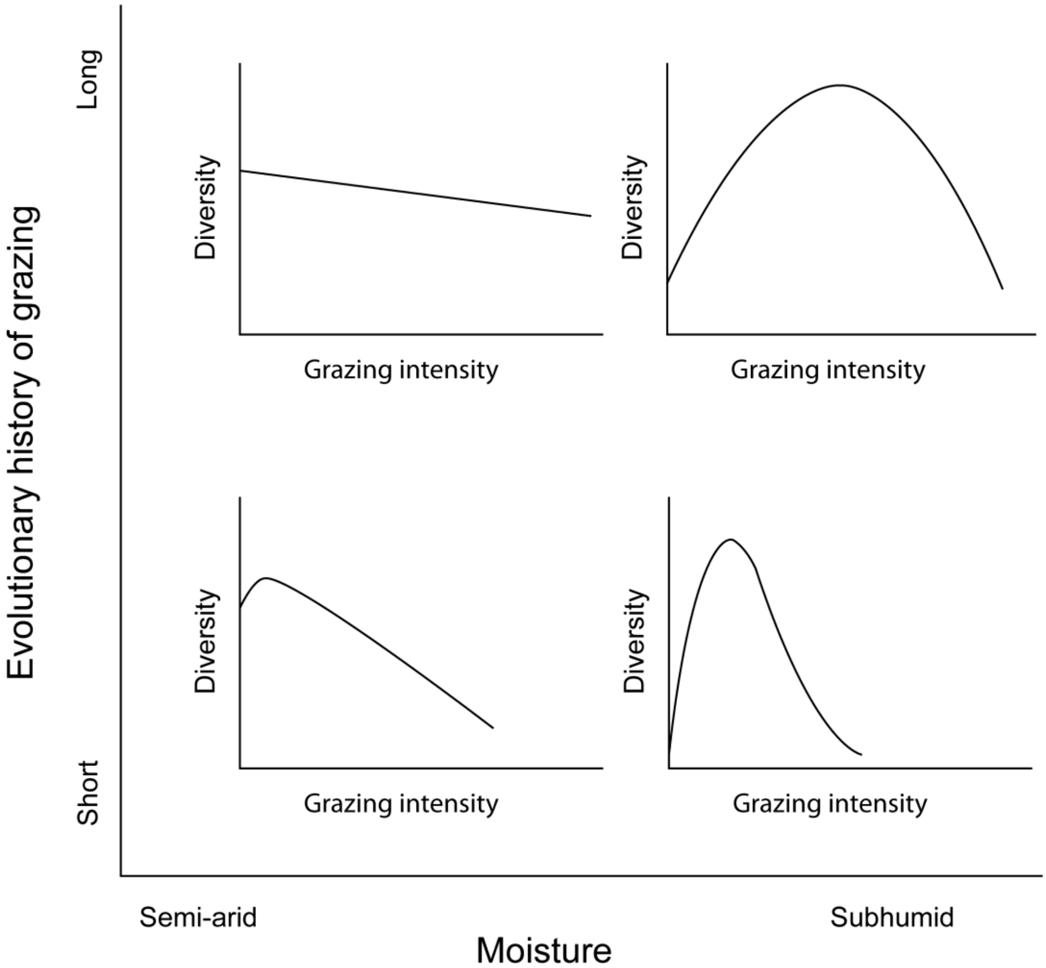
Shifts of species composition may then result from a combination of local extinctions of grazing-intolerant species and germination and establishment of new species in the sward (as space is made by the removal of vegetation and soil disturbances). Livestock also have significant indirect impacts on vegetation, through nutrient enrichment and trampling. Dunging results in local concentrations of nutrients (especially around feeding stations and water supplies) which can have profound impacts on the vegetation in such areas. Over wider areas the overall impact of nutrient deposition is offset by the removal of the vegetation by livestock, and their removal and through leaching from bare ground (Crofts and Jefferson, 1999; Lake *et al,* 2001). Overall, long-term grazing of semi-natural grasslands results in a gradual decline in nutrient status and this can be an important process that helps maintain botanical and associated diversity. This may also be particularly important for habitats (such as acid grasslands and heathlands) that are sensitive to eutrophication caused by nitrogen deposition resulting from atmospheric pollution (Aerts and Heil, 1993). In some situations, overall nutrient enrichment may occur if livestock are routinely moved between fertile and low-fertility semi-natural habitats such that differential use of habitats types occurs for foraging and dunging.

Livestock trampling can also lead to significant increases or decreases in soil compaction and changes in micro-topography, depending on substrate conditions, livestock type, the timing of grazing and stocking density. These impacts can in turn cause knock-on impacts on hydrology and water quality, aquatic ecology, soil invertebrates, plant communities and birds. It is well known that grazing in wet conditions on heavy soils can result in poaching leading to exposure of bare soil. Such bare areas can provide some benefits through the provision of germination sites for some plants, micro habitats for invertebrates and feeding areas for birds. However, extensive and heavy poaching is highly detrimental and can lead to severe erosion (and associated soil loss and pollution of water courses etc) and soil compaction. To avoid such problems livestock are often removed from grasslands during the winter months.

The overall impacts on vegetation and associated animal communities result from complex interactions amongst climate, soil type, habitat type and its history (eg its seed bank), defoliation extent and species selection, nutrient dynamics and substrate disturbance (Gibson, 2009). Consequently plant responses to grazing are difficult to predict. Importantly, from a biodiversity conservation perspective, small-scale variations in these factors and their interactions can lead to heterogeneous grasslands, which provide multiple niches that can support a high diversity of plants and associated species.

In general species composition changes at a particular location are most affected by the intensity of grazing, evolutionary history of grazing and soil moisture, as summarised in the Milchunas-Sala-Lauenroth (MSL) grazing model (Milchunas *et al,* 1988). As indicated in Annex Figure 2 the MSL model suggests that where moisture is not a limiting factor, then a hump-backed diversity-grazing relationship usually occurs, with grazing stimulating diversity most in communities with a long history of grazing, reflecting the past selection of species that are grazing-tolerant and canopy dominant. Thus under moderate grazing there is a mosaic of short grasses in heavily grazed patches and taller grasses in less grazed areas. This relationship is well known in many parts of Europe, such as for example on lowland heathlands in the UK and in Germany (Bunzel-Drüke *et al,* 2008; Lake *et al,* 2001). However, drier conditions cannot support taller grasses with the capacity to benefit from reduced grazing and therefore even moderate grazing tends to reduce species diversity in semi-arid habitats, especially in grasslands with a short evolutionary history of grazing.

Annex Figure 2: The generalised relationship between grass species diversity and grazing and soil moisture levels according to the Milchunas-Sala-Lauenroth (MSL) model (source redrawn from Gibson, 2009)



A weakness of the MSL model is that it is simplistic and does not accommodate the potential for alternative stable states where communities (and diversity levels) change suddenly once a grazing threshold has been passed. Such alternative states are implied in state-and-transition or state-and-threshold models (Laycock, 1991; Westoby *et al,* 1989). Under such circumstances grazing may lead to changes that are irreversible without additional forms of direct management intervention (such as burning or reseeding, to alter the dominant species).

Grazing has a considerable impact on the ecosystem as a whole, and is one of the key factors distinguishing different types of agricultural ecosystem. Some natural habitats in the EU are used for extensive livestock grazing, most typically by cattle, sheep and goats, although domesticated reindeer are kept in parts of northern Finland. Remaining natural habitats tend to be in areas where tree growth is limited by climatic extremes (eg very high or low levels of rainfall), latitude and altitude, and therefore in contrast to semi-natural habitats described below, such grazing is not normally necessary to maintain the open habitat, unless the habitat is in the transition zone with forest or scrub type habitats. Due to the extreme environments associated with these natural habitats they typically have very low levels of productivity. Most therefore cannot support high levels of grazing, or trampling as the vegetation and soils are often fragile. Consequently overgrazing is a major problem and widespread threat to such habitats and in many cases it is probably detrimental to have any significant grazing by domesticated livestock in the habitat (Hester, 1996; Shaw *et al,* 1996). Reducing grazing has also been shown to have significant positive impacts in terms of reducing carbon losses from peat erosion and oxidation (Worrall and Evans, 2009).

However, grazing may be now necessary on some nutrient sensitive natural habitats (and semi-natural habitats) to prevent the replacement of dwarf shrub or moss dominated vegetation by grasses (eg *Molinia*) as a result of airborne eutrophication (see Annex 2.10).

A key characteristic of most semi-natural habitats is that natural succession[43] is prevented by grazing, cutting and burning. These disturbances limit the development of shrubs and trees and therefore succession is held in check. Without these periodic disturbances succession will usually take place, albeit very slowly in some circumstances.

Thus livestock farming has played a significant role in creating and maintaining many semi-natural habitats and the continuation of certain low intensity farming practices is often crucial for their survival. Some grazing, in particular, is required to maintain the structure and composition, and hence ecological value, of semi-natural grasslands, such as calcareous grasslands (including limestone pavements / alvars), acid grasslands, floodplain meadows and coastal marshes, as well as heathlands and wood pasture, and some fens, dunes and shingle habitats (Ausden and Treweek, 1995; Burgess *et al,* 1995; Crofts & Jefferson, 1999; Dolman and Land, 1995; Frid and Evans, 1995; Gimingham, 1972; Gimingham, 1992; Hillier *et al,* 1990; Lake *et al,* 2001; Peterken, 1993). In fact some habitats that are maintained by grazing (such as pastoral woodlands) may also be analogues of once natural habitats that were formed by the actions of native wild herbivores (Hodder *et al,* 2005; Kirby, 2004; Vera, 2000).

Grazing of vegetation in many semi-natural habitats is also an important determinant of habitat suitability for many species. For example, vegetation characteristics are important in determining the suitability of wet grasslands for breeding wading birds (RSPB *et al,* 1997; Smart *et al,* 2006). Grazing creates shorter grass swards, which tends to increase foraging opportunities (ie prey visibility and accessibility) for birds and the presence of livestock and their dung attracts invertebrates, which are important prey for many birds. Grazing by cattle tends to produce tussocky swards, which often provide suitable cover for nests.

However, high levels of grazing (especially by sheep) reduce the vegetation that provides food and cover for invertebrates, and therefore although the accessibility of invertebrate food resources increases, their abundance declines. Furthermore, the loss of tall patches of vegetation and dwarf shrubs etc reduces cover for nesting in, and high stocking densities increase the proportion of eggs and young that are lost through trampling (Vickery *et al,* 2001). Therefore there are often complex interactions between the benefits and disbenefits

[43] ie the tendency for vegetation communities to develop towards a climax community, which is typically forest

of grazing. Sward requirements and the optimal grazing regime vary amongst species, with for example species that feed by sight on surface invertebrates (eg Lapwing *Vanellus vanellus*) requiring a short sward, whilst others that probe soils and feed by touch (eg Snipe *Gallinago gallinago*) benefit from taller swards that provide cover from predators (RSPB *et al,* 1997).

Bare areas of ground created by livestock can be important habitats for insects and reptiles, especially on sandy heaths etc which are important sites for rare and threatened species (Lake *et al,* 2001; Lake and Underhill-Day, 2004). In addition, many invertebrate-feeding birds require bare ground, or short-grass, for effective feeding (Schaub *et al,* 2010).

The presence of grazing animals in natural and semi-natural habitats also provides one further important direct benefit in that their carcasses provide important food resources for carrion feeding species, including many species that are of high conservation importance in Europe, such as vultures and some species of eagle (Donázar *et al,* 1997). Modern practices are now, however, to dispose of carcasses, and therefore this ecological benefit is declining and probably only significant in remote areas.

Grazing also has many indirect impacts. For example, livestock grazing supports other farming activities such as hay-making (although this is declining), which enables management that sustains valuable floristically-rich meadow habitats (see below). Conservation management through grazing also helps to conserve traditional livestock breeds, many of which are now very rare. Semi-natural pastures and non-grassland habitats (especially heathlands) generally have much lower productivity and nutritional value for livestock compared to the forage of improved grasslands (although the presence of herbs can beneficially increase vitamin and protein levels). Poorer quality pasture requires grazers that are physiologically capable of achieving an energy balance and other nutritional requirements from low-value forage. Various factors affect an animal's nutritional efficiency, but one that is widely recognized as being important is breed. In particular native breeds of livestock are usually better able to use poor quality vegetation than imported lowland-derived breeds (Crofts & Jefferson 1999). Furthermore many of the breeds that are best suited to restoring under-grazed semi-natural habitats, especially when removal of scrub or rank vegetation is required, are rare breeds. Thus conservation grazing of nature reserves etc is now one of the principal means of supporting the on going use of rare breeds.

A summary of the principal beneficial and detrimental impacts of grazing on biodiversity (for the main grassland types) is provided in Annex Table 2 below.

Annex Table 2: Impacts of livestock grazing on biodiversity

	Natural habitats	Semi-natural grasslands and other grazed habitats	Improved permanent grass	Artificial temporary grasslands
Habitats	Grazing by livestock not normally required to maintain habitat	Appropriate grazing maintains many important semi-natural habitats	Maintains habitat diversity and some habitats of biodiversity importance	Maintains grassland habitats in arable landscapes
Soil biodiversity	Soils are often sensitive to grazing, being vulnerable to erosion or compaction, which can lead to significant detrimental impacts. Sensitive grazing can help reduce eutrophication impacts on some vulnerable habitats.	Grazing helps to reduce nutrient levels (and eutrophication impacts). Normally no significant detrimental impacts, unless poorly managed.	Soil compaction from high stock densities, and soil erosion if poaching / overgrazing. Increased fertility from fertiliser use.	Soil compaction by machinery and high stocking densities. Soil erosion on bare fields following cultivation. Highly increased fertility from fertiliser use.
Plants	Some species are not able to tolerate grazing and trampling, so vegetation species-diversity likely to decrease with grazing	Grazing often helps maintain high levels of species diversity and characteristic species. Also indirect benefits of soil nutrient reduction.	Low value if highly improved and high herbicide use	Very low value due to monocultures and high herbicide use
Invertebrates	Often detrimental through loss of vegetation	Some invertebrates associated with animals, bare areas and dung, and less intensive grazing helps maintain overall population levels. But soil / dung invertebrates can be reduced by worming chemicals.	Some invertebrates associated with animals and dung, but intensive grazing reduces overall population levels. Soil / dung invertebrates can be reduced by worming chemicals.	Few benefits due to low soil and surface invertebrate populations.
Reptiles/amphibians	Often detrimental through loss of vegetation and trampling	Variable benefits, reptiles can benefit from open structure and bare areas created by grazing	Little benefit	Minimal value
Birds	Often detrimental through loss of vegetation and trampling	Appropriate grazing regimes create suitable habitat structure (and variation) for nesting and feeding,	Presence of manure and moderate livestock densities can support high invertebrate populations of	Provides some feeding opportunities in otherwise arable landscapes, unsuitable breeding

		and support associated invertebrate food resources. Grazing increases accessibility of invertebrates.	importance to birds, esp in winter. Grazing increases accessibility of invertebrates and can create suitable nesting habitat, but high stock densities result in high nest losses from trampling and reduced invertebrate food resources.	habitats due to high vegetation density and high trampling risk.
Mammals	Few impacts	Moderate benefits for invertebrate feeding species	Moderate benefits for invertebrate feeding species	Little benefit
Maintenance of rare / traditional breeds	Traditional breeds are normally favoured for grazing	Traditional breeds are often used for grazing	Occasional benefits	No benefits

Factors affecting appropriate biodiversity conservation grazing management measures

To ensure that grazing of semi-natural habitats is sustainable and has biodiversity conservation benefits, as is a key aim in many agri-environment schemes, it is important that the grazing regime (ie stock type, number and timing of livestock grazing) is tailored to the needs of the habitat and even the individual site. Stocking density usually has the most influence on vegetation and will vary according to the productivity, palatability and nutritional value of the vegetation, the species of livestock present and their age, size and nutritional needs, the grazing season, the number of days over which grazing occurs, and the grazing strategy / system (eg set or rotational) being used over the landholdings.

The selection of appropriate stock is particularly important as different types graze in different ways, with cattle often being the most appropriate livestock for promoting plant species diversity and creating good sward conditions for birds and invertebrates. Goats and cattle are also able to open up areas that have been invaded by scrub. Different livestock breeds also vary significantly in their suitability for different habitats and their grazing behaviour (Small *et al,* 1999). The choice of livestock also has an influence on sward composition, though it is normally considerably less than the impacts of stocking density (Crofts & Jefferson 1999).

Grazing is often limited by seasonal conditions, especially in cold northern, alpine and continental parts of Europe, and on river floodplains and other areas subject to flooding or high water tables. Studies of grassland productivity and livestock condition have also found that prolonged periods of summer and winter grazing on semi-natural grasslands can be inappropriate for agronomic and animal welfare reasons (Tallowin, 1997). However, such problems can sometimes be overcome by judicious use of supplementary concentrated feeds, rather than substitution of semi-natural grassland with improved grasslands for silage. This approach was for example successfully trialled by a LIFE Nature project, to maintain beneficial winter grazing on the limestone grasslands of the Burren, in Ireland (Dunford, 2002).

The timing of grazing also needs to take into account conservation needs and objectives for a site. For example, although cattle grazing can provide suitable sward structures for breeding birds it also carries a cost, as high livestock densities can also result in a high proportion of the clutches of ground nesting birds being destroyed by trampling (Chamberlain, 2002). For example, trampling of 35–70% of wader nests has been reported at grazing densities of c. 2·5 cattle/ha (Beintema and Müskens, 987; Green, 2011). These detrimental effects can be minimized through manipulation of the timing and density of grazing, but there may be a fine balance between the nest-loss cost of grazing and the benefits gained from managing the sward characteristics to the benefit of both nesting and foraging waders.

A review of stocking levels that are currently recommended for nature conservation purposes on some semi-natural habitats in England revealed that a very wide range of stocking densities are appropriate amongst the habitats considered (Kirkham *et al,* 2003). This highlights the difficulty of setting generic grazing regimes under agri-environment schemes that will achieve biodiversity objectives. It should also be borne in mind that appropriate grazing regimes will also vary according to local site conditions (such as its soil type, hydrological conditions, grazing history, specific conservation objectives and level of grazing by wild herbivores).

Improved and temporary grasslands

Improved grasslands tend to be intensively grazed (and/or cut for silage – see Section 2.2.8). This may have little impact on plants and may even help increase plant species diversity. But intensive grazing produces a short and uniform sward that reduces the biomass present, which in turn reduces food resources, shelter and breeding sites for invertebrates. Consequently many invertebrates are unable to tolerate high grazing pressures (Pöyry *et al,* 2006), which in turn affects invertebrate predators such as amphibians, reptiles, mammals and birds. The reduced cover from tall vegetation also has a more direct effect on vertebrates as a result of the loss of shelter and breeding sites. Thus the impact on plant diversity and structure has substantial knock-on effects on the entire ecosystem and its associated animal communities.

Permanent crops

To conclude the section on impacts of grazing, certain attention should be paid to traditional orchards and olive groves. They often have a permanent understory that is grazed by sheep. Where grazing intensity is low, and biocide application is minimal, these habitats are likely to be considered as high nature value areas (Cooper *et al,* 2007).

9.1.2 Burning

Some natural and semi-natural habitats that are grazed by livestock are subject to burning management, particularly in the UK. Grasslands and heathlands (especially in the uplands) are most affected, but some peatland habitats such as some blanket bogs are also occasionally burnt, although UK burning regulations for example forbid such practices. The principal aims of burning are to prevent establishment of woody species, to reduce litter and release nutrients, which stimulates earlier growth and temporarily increases the accessibility, palatability, and nutrient content of forage for grouse and livestock. Agricultural burns are usually uncontrolled and therefore tend to cover very large areas in one burn, typically from tens to hundreds of hectares. Grassland burning rotations are often very short, with fires typically returning every couple of years or annually in some areas.

Burning is also a common management practice on moorlands (ie upland dwarf shrub heathlands) in the UK that are managed for the shooting of Red Grouse (*Lagopus lagopus*). This is usually more planned and controlled, and carried by burning strips of only about 30 m width and typically about 0.5 ha in total area, but larger fires are not uncommon. Typically each strip is burnt every 10-15 years.

It is evident from a number of studies and reviews (Shaw *et al,* 1996; Tucker, 2003) that in appropriate areas and circumstances, carefully managed burning can play an important role in the maintenance of some open semi-natural upland habitats of high conservation importance. Fires may also help to maintain low nutrient conditions, which may be particularly important under current circumstances where atmospheric pollution results in nutrient inputs from rainfall which are higher than former natural levels. Burning of small patches can also increase vegetation structural diversity and species-richness in plants, invertebrates and birds of heathland habitats. Regular burning also reduces fuel loads and thus to some extent the risks of large and very hot wildfires.

However, the inappropriate fires such as on peatlands or outside the burning season and inadequately managed fires have significant detrimental impacts, including:

1. Ignition, combustion and loss of peat and humus layers by hot fires in dry conditions.
2. Increased rates of run-off and erosion (particularly after hot fires and where large or old stands of vegetation are burnt, and on steep slopes), which exacerbates the impacts of overgrazing.
3. Reduction of structural and species diversity and vegetation composition changes if carried out too frequently or over large areas.
4. Post-fire establishment of invasive species such as *Pteridium aquilinum* (bracken).
5. Destruction and long-term exclusion of fire sensitive and slow colonising species.
6. Removal of cover for ground-nesting wildlife and destruction of birds nests and clutches if fires occur during the spring and summer.

Furthermore, wildfires sometimes develop from poorly managed fires, which can be extremely severe, especially when they occur during dry weather (which is the most likely time). They can extend over very large areas and may also result in combustion of peat leading to soil degradation, severe erosion and long-term ecological and hydrological impacts, which may include severe reductions in the populations of species that are unable to escape.

9.1.3 Cutting for hay

Many semi-natural grasslands in Europe are cut for hay (and therefore often known as meadows), primarily to produce forage that can be stored for the feeding of cattle in winter. Hay meadows tend to become more common towards the east of Europe and at higher altitudes, because larger amounts of forage need to be stored for the longer winters in such areas. Typically the grass is cut when it is about 50-120cm high, which results in a relatively late cutting compared to silage (see below) and allows many plant species to flower and set seed. Cut hay is left to dry before collection and stacking, which allows seeds to drop. The act of cutting is non-selective and therefore tends to encourage the growth of grasses whilst reducing tall herbs and eliminating woody plants. However, the disturbance from cutting and high light levels allow low growing herbs that can flower and set seed to exist in the sward. The removal of the cut grass from the field also tends to result in a long-term decline in nutrient levels.

The late mowing of hay meadows is also important for many ground-nesting birds, because their young are able to fledge before they are cut. However, some late breeding birds are often killed by fast modern mechanical mowers, which have been a key cause of declines in some species such as the Corncrake (*Crex crex*) (Wilson *et al,* 2009). However, casualties amongst young and adult birds can be reduced by wildlife friendly cutting techniques (eg from the inside outwards) and many investigations have shown that rotation mowing machines kill or injure seven times more animals (amphibians, insects like grasshoppers and bees) compared to cutter bar mowers (Humbert *et al,* 2010; Oppermann and Krismann, 2003).

Meadows are also often grazed, typically after hay cutting in the autumn and in dry and mild areas through the winter. Spring grazing may also occur, though this can reduce hay yields. Grazing animals tend to select the most nutritious grasses and trampling (by cattle especially) helps to break up the litter layer and create bare soil patches, which in combination help herbs to establish and flourish (Crofts & Jefferson, 1999). As a result many traditionally managed semi-natural meadows have very high plant diversity and are of considerable conservation value, both for their plants and associated invertebrate communities (Veen *et al,* 2009), and are consequently listed in Annex II of the Habitats Directive. Indeed, some Annex II species are only found in hay meadows, such as the butterflies *Phengaris teleius* and *Phengaris nausithous*. Many alpine hay meadows are for example of exceptional value for butterflies, particularly where grazing does not occur or is light (Dolek and Geyer, 1997). Variability in mowing times also helps to maintain in-field and landscape level diversity (Cizek *et al,* 2011).

Many meadows occur on poor soils that are unsuitable for arable farming, which further lose nutrients through hay removal, and therefore many meadows can only be cut once or twice per year unless they receive fertiliser (Kapfer, 2010). Meadows also frequently occur on floodplains, where winter flooding with sediment laden water helps to maintain soil fertility. Some of these hay meadows are of high botanical importance, whilst others with high fertility levels and prolonged winter flooding can be of very high conservation importance for wintering water birds, including geese and swans that feed on the grasses that grow in such conditions and dabbling ducks which benefit from the high abundance of seeds (Nagy, 2009; Tucker and Evans, 1997). Away from flood plains waterways were sometimes constructed to supply water meadows and upland pasture. Many such waterway systems are ancient (Küster and Keenleyside, 2009) and are of high botanical and cultural interest, but are increasingly rare.

9.1.4 Drainage and flood control

Due to the favourable growing conditions many grasslands occur in areas with areas with high rainfall, or where there is frequent flooding or high ground-water levels etc. In particularly wet areas grasses are unable to thrive and such habitats are dominated by mosses (eg *Sphagnum* spp) and other wetland specialists, resulting in natural blanket bogs and other mire habitats that may be grazed to varying extents. The drainage of bogs by the cutting of channels has been carried out for centuries and has led to the creation extensive areas of semi-natural grassland, though at the expense of species associated with the natural bog habitat. However, in more recent decades drainage has often just been the first stage in a process of agricultural improvement because the drier ground allows vehicle access so that fertilisers, herbicides and pesticides can be used, and on suitable ground the grassland may then be ploughed up and reseeded. Such improvements allow higher stocking levels and the cutting of grass for silage. As a result this sequence of interrelated events is undoubtedly a major cause of declines in species of bogs and wet grasslands, such as Lapwing (*Vanellus vanellus*), Redshank (*Tringa totanus*), Curlew (*Numenius arquata*) and Snipe (*Gallinago gallinago*) in the UK (Newton, 2004).

Similar impacts occur on lowland floodplains and coastal marshes where flood management measures avoid or reduce flooding resulting in the loss or significant degradation of wet grassland habitats. In contrast, some flood manage measures may result in the maintenance / creation of semi-natural grasslands that act as flood storage areas (ie washlands) during peak river flows. These can be of very high importance for wintering water birds, and such sites are often designated as Special Protection Areas (SPAs) under the Birds Directive. They may also provide suitable breeding habitat for waders, but nests may often be flooded out in such sites (Ratcliffe *et al,* 2005); which is a problem that may be increasing as a result of climate change.

9.1.5 Use of organic and inorganic fertilisers

The use of fertilisers is a common means of increasing the productivity of grasslands (and is almost universal in non-organic improved grasslands and crops) although Central- and Eastern European grasslands are rarely fertilised (Báldi and Batáry, 2011). Nitrogen is the nutrient that most often limits grassland productivity and is therefore the main constituent of most fertilisers. However, phosphorus can be limiting in some grasslands and potassium, even if not already limiting is readily leached (Gibson, 2009).

Many hay meadows receive some farmyard manure, such as in upland areas of Britain (Jefferson, 2005). Such low level fertilisation merely offsets the losses of nutrients through hay removal (see above) and does not normally have a significantly detrimental impact on the biodiversity value of the grassland. However, more typical agricultural applications of fertiliser (such as liquid slurry and artificial fertilisers) significantly increase biomass production through denser and taller swards and also causes changes in species composition, leading to grass dominance and reduced plant species diversity (Kleijn *et al,* 2009).

Plants species of natural and semi-natural habitats have generally evolved in low nutrient conditions and therefore species of these habitats are highly sensitive to fertiliser applications. Consequently, even low levels of fertiliser use are likely to degrade the quality of such habitats. For example, in UK grassland high forb diversity only occurs in grasslands receiving less than 15kg/ha (McCracken and Tallowin, 2004). Significant regular use therefore results in the conversion of semi-natural habitats into agriculturally improved grassland, with associated substantial declines in species diversity. Furthermore, this process becomes increasingly irreversible as a result of the accumulation of nutrients in the soil and gradual die-off of the former semi-natural habitat's seedbank. Within improved grasslands it appears that increasing amounts of fertiliser use further reduce plant species diversity, such that in the UK only three forb species were found on livestock farms where nitrogen inputs exceeded 75kg/ha (McCracken and Tallowin, 2004).

Increases in plant biomass and declines in plant species diversity result in knock-on impacts on invertebrates, including for example the loss of species that favour shorter and sparse vegetation. Reductions in plant diversity are considered to result in declines in some invertebrates groups including Acari (mites), Colembiola (springtails) Diptera (flies), Coleoptera (beetles), Orthoptera (grasshoppers and crickets) and Myriopoda (millipedes and centipedes) (Nagy, 2009). However, the impacts appear to be variable across taxa. For example, changes in butterfly and moth abundance in grassland sites in Sweden showed contrasting trends for species dependent on nutrient-poor conditions, which tended to decrease, and species dependent on nutrient-rich conditions, which tended to increase (Öckinger *et al,* 2006, cited in Stoate *et al,* 2009). It appears that some groups such as earthworms and other decomposers can benefit from moderate fertiliser applications, especially farmyard manure (Vickery *et al,* 2001). This may benefit invertebrate-feeding birds (Tucker, 1992), but such benefits may be offset by increases in sward density and height from fertiliser use, as this interferers with foraging efficiency and prey availability.

The impacts of high fertiliser use on biodiversity in cereal fields is less clear. For example, a study in Hungary found that fertiliser use negatively influenced native plant species, but promoted new colonists (neophytes) including invasive species (Kovács-Hostyánszki *et al,* 2011b). No clear relationship between fertiliser quantity and bird abundance was found (Kovács-Hostyánszki *et al,* 2011c).

9.1.6 Cultivation

Many semi-natural grasslands, particularly in north and western Europe, have now been agriculturally improved as a result of actions such as drainage, liming of acidic grasslands and shrubland habitats, removal or breaking-up of stones and rocks which prevent vehicle access and ploughing, fertiliser applications and herbicide use. The next stage in agricultural intensification is then often the ploughing up of the grassland and reseeding. Grasslands are typical sown with a few selected grass cultivars, such as *Lolium* spp (sometimes with clover) that through breeding programmes are adapted to high nutrient conditions etc. The act of ploughing and use of fertiliser encourages the establishment of weeds and therefore reseeding is also usually accompanied by a significant increase in herbicide use (or mechanical methods of weed control in organic systems). Ploughing, re-sowing and herbicide use therefore leads to species-poor uniform grasslands which provide limited invertebrate food and after their establishment, limited access to food (McCracken & Tallowin, 2004).

Ploughing and other tillage operations also result in the direct mortality of soil invertebrates and disruption of the soil ecosystem. This leads to reduced earthworm and other soil invertebrate populations, which in turn reduces food availability for soil-invertebrate feeding birds (Tucker, 1992). The impacts of regular cultivation on soil biodiversity, combined with the soil's exposure, also reduce organic matter and general condition. This can have impacts on a variety of ecosystem services including the ability of the soil to produce crops and sustain livestock, resist wind and water erosion and absorb and retain water. Consequently regular and inappropriate cultivation techniques can lead to significant carbon losses, although these can be impacts can be reduced using sensitive cultivation techniques (Holland, 2004; Smith, 2008).

In southern orchards and olive groves, the herbaceous understory may be removed (either mechanically or with herbicides) to avoid competition for moisture with the trees, which can have significant impacts on species that are dependent on such habitat elements. However, the disturbance from well-timed occasional tillage (once or twice a year) can allow the development of a significant flora and fauna, with bare soil being a valuable micro-habitat for some invertebrates, which in turn support invertebrate feeding birds.

9.1.7 Crop types and rotations

Crop type has an important influence on biodiversity, primarily as a result of its height, density and other structural attributes. In general sparse and short crops tend to support more species as they allow some non-crops plants to survive, together with associated invertebrate species that rely on them as food plants etc, and in turn, their predators. Modern cultivars of many crops grown under their intended intensive conditions often grow so quickly they out-compete many non-crop plants, even in the absence of herbicides etc. Furthermore, many crops, such as cereals, oil-seed rape and maize, rapidly become tall and dense for many typical farmland birds and mammals to forage in efficiently (especially recently fledged birds) and even nest in. This problem is further exacerbated by the considerable increase in autumn/winter-sowing of cereal crops in parts of Europe over the last 50 years or so, which results in tall and dense crops by the start of the typical breeding season. But it is important to note that crop nesting preferences vary according to regional farming practices and growing conditions. For example, in Finland and Sweden, traditional winter crops (mainly for Rye) provide valuable habitats for many species, including Skylark (*Alauda arvensis*) and Grey Partridge (*Perdix perdix*).

Flowering crops, such as oil-seed-rape provide food resources for nectar feeding species and thereby help support pollinators, and in turn their predators etc. However, some studies suggest that such crops may have detrimental impacts on nearby vegetation of higher biodiversity value by drawing pollinators away (Holzschuh *et al,* 2011).

Some species that normally nest in tall vegetation, such as reedbeds, have adapted to nesting in tall crops, for example the Linnet (*Carduelis cannabina*) now regularly breeds in oil-seed rape (Moorcroft and Wilson, 1999). But few species benefit from crops compared to flower-rich grasslands and semi-natural habitats. Seed bearing crops, such as cereals, provide winter food for birds, but these sources are often lost as a result of the tendency for early cultivation and sowing of crops; as a result stubbles are no longer retained through the winter (Wilson *et al,* 2009). Harvesting machinery is also increasingly efficient, and therefore the amount of spilt grain in stubbles is now much reduced.

Improved and, in particular intensive grasslands, do not normally produced seeds as a result of grazing and/or frequent cutting, and therefore provide very limited food resources for seed-eating birds (Buckingham *et al,* 2006; Vickery *et al,* 2001). Consequently there is considerable concern over the status of seed-eating species in improved grassland dominated landscapes. This problem may also be exacerbated by recent increases in the growing of maize as fodder crops, because these appear to hold particularly low levels of invertebrates and seed bearing plants (probably due in part to the use of herbicides during their early establishment), and are therefore also of low value for birds (Westbury *et al,* 2011). Research is therefore being undertaken to identify practices that may be able to overcome low seed availability in livestock dominated farming areas, such as measures to introduce arable crops into the landscape (Robinson *et al,* 2001) or the growing of cereal-based whole-crop silage (Peach *et al,* 2011).

Variation in crop type is of particular importance in promoting landscape-scale diversity, and in providing the variety of resources requirements that are often needed by species (see Section 2.1.2). The Skylark (*Alauda arvensis*), for example, requires a variety of crops within its territory if it is to successfully fledge more than one brood in a season, as is required to maintain populations (Chamberlain *et al,* 1999). This is because crops that are suitable for first broods become too tall for breeding, so they require less dense and tall crops for subsequent broods, such as spring-sown crops or semi-natural grassland. Hence, even patches of intensive arable farmland can be highly beneficial in terms of increasing avian diversity in improved grassland dominated landscapes (Robinson *et al,* 2001). Hares (*Lepus europaeus*) also benefit from increasing habitat heterogeneity especially in intensively managed and homogenous farmland landscapes (Smith *et al,* 2004).

9.1.8 Silage production

The reseeding of grasslands and use of high levels of fertiliser typically result in the reduction of grazing and conversion of hay cutting to silage production, where the forage is cut early, stored and then taken to animals that are held in high density stockyards. The grass is intentionally cut before seeding to maximise its nutritional value and this results in an absence of food resources for seeding birds etc (Buckingham *et al,* 2011). Furthermore, livestock are increasingly kept off grasslands and fed silage, sometimes all year as this is more productive. This is also detrimental for biodiversity, as animal dung (particularly from cattle), supports invertebrates, some of which are important prey for several species of bat (Duverge and Jones, 2003) and many birds (Vickery *et al,* 2001).

The early cutting of silage is also a major problem for ground-nesting birds, which results in very low rates of breeding success for many species (Oppermann and Spaar, 2003). Furthermore, other mechanical operations on intensively managed grasslands frequently occur, including the spreading of fertiliser, topping of vegetation as weed control and rolling. These cutting and other operations are so frequent that there is insufficient time for breeding in between, and therefore egg and chick mortality rates are so high such grasslands become sink habitats, ie they attract birds but breeding success is lower than mortality rates (Buckingham *et al,* 2006).

9.1.9 Herbicide and pesticide use

Pesticides are now commonly used on all improved grasslands (mainly herbicides) and intensely cultivated crops (herbicides, insecticides, molluscicides and fungicides), and certain approved products are also used occasionally on organic farms. Such pesticides have direct impacts on biodiversity as a result of their intended toxicity to pests, but also similar non-target species. The direct impacts of pesticides through unintended toxicity on species such as birds and mammals is now much reduced following the banning of persistent toxic substances such as DDT. However, the direct impacts of pesticides on targeted weeds is known to be the most important factor affecting invertebrates in herbicide management systems, with an established correlation between phytophagous invertebrates and weed abundance (Hawes *et al,* 2003). These impacts together with those on insect pests, and non-target species, undoubtedly have substantial knock-on impacts on food webs, competitors and parasites that will affect the entire ecosystem of intensively managed farmland habitats.

Due to the complexities of the issue and problems of controlling for landscape-scale effects, relatively few detailed studies have been carried out of the impacts of pesticides on biodiversity. However, some important long-term and detailed studies in the UK have documented long-term declines in arable weeds (such that they are now extremely rare) and many insect groups in intensively managed farmland (Aebischer, 1991; Potts *et al,* 2010). In Hungary, insecticide use in wheat fields negatively influenced bees (Kovács-Hostyánszki *et al,* 2011a). Furthermore, the indirect impacts, resulting from the loss of broad-leaved weeds and associated invertebrates, were shown to be the primary cause of declines in the Grey Partridge (*Perdix perdix*)(Potts, 1986; Potts, 1997). Evidence strongly suggests that the use of broad-spectrum pesticides has been one of the main causes of the decline of non-crop plants (ie weeds), many invertebrate groups and some birds in arable farmland habitats across much of Europe (Boatman *et al,* 2004; Campbell *et al,* 1997; Geiger *et al,* 2010b; Potts, 1997; Stoate *et al,* 2001).

9.1.10 Irrigation

Agricultural landscapes with traditional, channel-based irrigation systems offer a network of freshwater habitats, which can benefit some species. For example, in Southern Portugal, the species richness of wild carnivores was found to be high in landscapes with dense networks of irrigation channels and tree lines bordering agricultural fields (Pita *et al,* 2009). Irrigation was also positively associated with the abundance of Otters (*Lutra lutra*) and Egyptian Mongoose (*Herpestes ichneumon*).

In most of Europe modern irrigation systems are only used on the most productive, or potentially productive croplands. Consequently, such irrigated farmland is generally very low in biodiversity in comparison with other European agricultural systems, except compared to intensive lowland arable systems of Northwest Europe (Reidsma *et al,* 2006). The introduction of irrigation to modern short cycle vegetable and fruit crops ,such as tomatoes, results in relatively moderate additional biodiversity impacts as the crops generally harbour few species (primarily as a result of intensive cultivations and pesticide use). However, the introduction of irrigation in dry arable or permanent crop systems is associated with the intensification of other agricultural practices, the combined effect of which is detrimental to biodiversity. For example, the introduction of irrigation in extensive cereals in Spain has been shown to result in severe declines in seven farmland bird species (Brotons *et al,* 2004; Ursúa *et al,* 2005). Trickle irrigation of permanent crops such as olives or citrus, for example in Crete, Apulia in Italy and Andalusia in Spain, is associated with soil erosion and salinization, which has an indirect impact on soil biodiversity and weed diversity (European Commission, 2010d).

9.1.11 Hedgerows and boundary management

Hedgerows, tree lines, ditches and other boundary features are important habitats features in many agricultural landscapes (O'Connor and Shrubb, 1986; Wilson *et al,* 2009). Good quality hedgerows, which are relatively large and old, may be relatively species rich in terms of plants compared to surrounding farmland fields, and they can support diverse invertebrate communities. The presence of hedgerows, and associated trees etc therefore helps to diversify the landscape by providing additional structural and compositional diversity. However, many of the no-farmland species associated with hedgerows are generalist woodland-edge and scrubland species. Such communities are also often impoverished as a result of the impacts of farming practices on them, including severe and regular cutting, and fertiliser and pesticide drift. Hedges, ditches and patches of other non-farmed habitats may help to promote ecological connectivity in highly fragmented farmland landscapes (Gilbert-Norton *et al,* 2010; Spellerberg and Gaywood, 1993), but evidence suggests that this function is relatively limited and that only generalist species are likely to benefit (Davies and Pullin, 2007).

Hedgerows do, however, provide valuable habitats for farmland species, including nesting sites for many birds that forage within the cropped areas, and over-wintering areas for invertebrates. But it is important to note that not all agricultural birds benefit from hedgerows, as they harbour predators and enclose the landscape. Thus the introduction of hedgerows, shelter belts and woodlots into open habitats (such as moorlands, wet grasslands and steppes), can be very damaging (Tucker & Evans, 1997).

Non-cropped field margins and buffer strips can provide additional habitat components in agricultural landscapes, and important protection of watercourses and other sensitive adjacent habitats from fertiliser and pesticide drift and nutrient-rich run-off (see discussion of external impacts in Annex 2.1, p227) But on intensive grasslands and arable fields, their direct botanical value is usually constrained by the highly fertile soils, such that they tend to develop species-poor, tall and dense swards. Nevertheless, they can support higher invertebrate populations than found in conventional crops, and be particularly useful in terms of enhancing pollinator populations if sown with nectar rich plants (Potts *et al,* 2009; Smith *et al,* 2008; Woodcock *et al,* 2007). Furthermore, if field margins and buffer strips are allowed to flower and seed, especially if they are sown with wildflower mixes or game crops (eg under agri-environment schemes) they can provide rich food sources. Sowing with nectar-rich plants can also provide good habitat for butterflies and other invertebrates (though mostly generalists species), which can support pollination of the nearby crops etc. Unfarmed margins also help to permit the cutting of hedges in late winter (rather than before crops are sown) when the supply of berry food for birds has been exhausted. In addition, uncut grass field margins provide a nesting habitat for some birds (for example, Stoate & Szezar, 2001), and an over-wintering habitat for beneficial predatory insects which control cereal aphids in the summer, reducing the need for summer aphicides.

In terms of biodiversity conservation objectives, it is therefore important to retain good quality non-farmed boundary habitats. But such habitats often have relatively little impact on many specialist farmland species, which are more influenced by in-field habitat characteristics and the farming practices that affect them. The maintenance and enhancement of boundary habitats should not therefore normally be seen as an alternative to in-field conservation measures.

9.2 Annex 2.2: Biodiversity impacts of organic farming on different taxa

This Annex is related to Chapter 2 which includes a description of the principal differences between organic systems and conventional farming and their resulting influences on habitat quality and diversity. The impacts of these influences on key taxa groups are briefly summarised below.

9.2.1 Arable weeds and plant diversity on farms

Numerous studies in a range of European regions have consistently shown that organic arable fields have a greater abundance and diversity of arable weeds, particularly broad leaved weeds (Aavik and LIIRA, 2010; Bengtsson *et al,* 2005; Fuller *et al,* 2005; Gibson *et al,* 2007; Hole *et al,* 2005; Holzschuh *et al,* 2007; Roschewitz *et al,* 2005; The Soil Association, 2000). For example, a study found more than twice as many plant species and more than seven times higher cover (Winqvist *et al,* 2011).

This difference was found even when the organic farms contained a lower proportion of arable area, and between paired farms in landscapes with high plant diversity as well as in species poor homogenous arable landscapes (Winqvist *et al,* 2011). Conventional arable farmers may nullify the landscape effect on weed diversity by increased chemical weed control where weed pressure is higher (Gabriel *et al,* 2010), though this is not always the case (Roschewitz *et al,* 2005).

Field margins and boundaries of organic fields are generally richer in plant species, due to lower disturbance, wider and more contiguous habitats, and more sympathetic management of plant rich habitats such as ditches (Aavik & LIIRA, 2010; Petersen *et al,* 2006; The Soil Association, 2000). However, particular habitat characteristics such as wider hedges shading the hedge bottom may reduce species richness in paired comparisons.

Weed species diversity is strongly affected by landscape complexity, which provides a greater species pool and shorter distances from semi-natural habitats that could act as sources for colonization (Gabriel *et al,* 2006), and on arable farms in more complex landscapes, weed species diversity may not differ significantly on organic and conventional arable fields (Aavik & LIIRA, 2010; Roschewitz *et al,* 2005). However, weed communities on organic farms may be more stable and less dependent on outside recolonization than conventional arable farms (Roschewitz *et al,* 2005; Weibull *et al,* 2003). Most studies have looked at weed species diversity and abundance without differentiating weed species with higher conservation value in that region, for example between 'agrotolerant' weed species that are generally common in agricultural fields and grasslands, and 'nature-value' species, including rare weeds and species mainly found in natural and semi-natural habitats in that region (Aavik & LIIRA, 2010). Organic farms in Estonia and Denmark were found to be particularly beneficial for 'nature value' species with lower disturbance tolerance (Aavik & LIIRA, 2010; Petersen *et al,* 2006). Rare species and arable specialist species on the Red List were more frequent on organic farms in several studies (Gabriel *et al,* 2006; Roschewitz *et al,* 2005; The Soil Association, 2000). Certain weed species have been found to occur more consistently on organic farms than on conventional farms, irrespective of landscape complexity (Roschewitz *et al,* 2005).

9.2.2 *Soil invertebrates*

Some studies have shown that non-pest invertebrates, for example earthworms, were more abundant and diverse on organic farms, but responses are inconsistent, and are probably more influenced by small scale impacts of management such as soil organic matter, tillage and other disturbance, as well as soil type, and other edaphic factors (Bengtsson *et al,* 2005; Hole *et al,* 2005).

9.2.3 *Carabid beetles*

Carabid beetles have shown inconsistent responses to organic farming (Fuller *et al,* 2005; Bengtsson *et al,* 2005; Hole *et al,* 2005; Winqvist *et al,* 2011). This may be because carabid species commonly found in agricultural fields are generalist predators, with frequent intraspecific predation, greater abundance in open environments, and high turnover with neighbouring habitats (Cole *et al,* 2005) Several species are capable of hibernating within arable fields and are thus not dependant on the quality of field margin habitats (Winqvist *et al,* 2011).

One study found that dung beetles were more abundant and diverse on organic farms (Hutton & Giller 2003).

9.2.4 *Spiders*

Organic arable fields generally contain higher spider diversity, as a result of the more complex crop and weed structure which offers a wider range of habitats, and a greater abundance of non-crop habitats from which spiders can recolonize the field (Fuller *et al,* 2005; Hendrickx *et al,* 2007; Hole *et al,* 2005). In contrast, organic ground cover management in perennial crops may result in lower spider species richness because of the low disturbance level (Bruggisser *et al,* 2010). Spider diversity in European agricultural habitats is primarily determined by recolonization from patches of semi-natural habitat, and there are no species specialising in agricultural habitats (Schmidt and Tscharntke, 2005).

9.2.5 *Taxa with population ranges at larger scale*

Studies of the impacts of organic farming at the farm scale show less consistent effects on taxa (such as flying insects, bats and birds) whose populations are dependent on resources and habitats on a much larger scale. This is probably because most studies are carried out in intensive agriculture landscapes in which the very few organic farms form relatively small isolated habitat 'islands' in an intensively managed landscape.

9.2.6 *Bees*

Landscapes with higher proportions of organic crop fields support greater bee species richness and abundance than conventional farming landscapes, by offering more food resources (Holzschuh *et al,* 2008), for example from grass-clover leys in intensive dairy landscapes in Ireland (Power and Stout, 2011) and from the greater weed diversity in organic wheat (Holzschuh *et al,* 2007). Solitary bees are significantly more abundant and species rich where the farm offers more semi-natural habitat or fallow land suitable for nesting (Holzschuh *et al,* 2008).

9.2.7 Hoverflies

Adult hoverflies show inconsistent reactions to organic farming, but aphidophagous (aphid-eating) hoverfly larvae have been shown to be more abundant on organic arable farms (Gabriel *et al,* 2010).

9.2.8 Butterflies

Various studies have found higher non-pest butterfly visitation due to a greater flower abundance and diversity on organic farms (Gabriel *et al,* 2010; Hole *et al,* 2005; Weibull *et al,* 2003). Studies of butterfly abundance on a landscape scale found that local butterfly species richness was positively affected by a large proportion of organic farming in the landscape, but that these butterflies were only more abundant on those organic farms isolated in areas dominated by conventional farms (Rundlöf *et al,* 2008; Rundlöf and Smith, 2006). This can be explained by the fact that butterflies in low-quality habitat actively find resource hotspots on a landscape scale, and congregate there (Rundlöf *et al,* 2008). Impacts of organic farming on butterfly larval abundance and diversity are not available, but the fact that butterfly species richness is positively correlated with landscape complexity suggests the importance of non-crop larval habitats (Jonason *et al,* 2011).

9.2.9 Bats

Wickramasinghe *et al* (2003) and Fuller *et al* (2005) found that bat activity was significantly higher on organic farms, which had taller and more contiguous hedgerows for bat flight lines and better quality water habitats for food resources.

9.2.10 Farmland birds

Many studies have found higher numbers of bird species and territories, and greater abundance of farmland birds, on organic farm plots than on paired conventional farms (Chamberlain *et al,* 2010; Geiger *et al,* 2010a; Hole *et al,* 2005; The Soil Association, 2000; Winqvist *et al,* 2011). However, the specific effect of organic farming on farmland bird species varies according to the species, the landscape context, and specifics of organic farm management.

Generalist farmland birds and woodland birds generally benefit from the more diverse crop and weed structure of organic farms, including green manures, and their greater variety and abundance of on-farm habitats in hedges, fields and field margins (Batáry *et al,* 2010; Chamberlain *et al,* 2010). In contrast, specialist open farmland birds are negatively affected on organic farms with a higher density of hedgerows and trees, probably due to increased predation rates, including more abundant corvid nest predators (Fischer *et al,* 2011; Gabriel *et al,* 2010). However, in intensive arable landscapes they may benefit from the lower disturbance and crop density of organic arable fields, or the higher frequency of temporary grassland (Batáry *et al,* 2010), or conversely in landscapes dominated by grassland they benefit from the higher frequency of arable fields in organic farms (Piha *et al,* 2007).

Organic arable fields often provide more bird food resources, including more invertebrates and seeds, due to the lack of pesticides and greater weed abundance, and to differences in crop rotation (Fischer *et al,* 2011; Hole *et al,* 2005; The Soil Association, 2000). However, the size of the benefit for bird populations in individual studies depended on whether the organic farm system differed significantly from surrounding conventional arable practices, some of which might also benefit birds (eg conservation tillage and set-aside). Whether the organic farm provided significant resources compared to conventional arable farms also depended on the impact of specific organic management practices, such as the frequency of winter stubble or the intensity of mechanical weed control (Geiger *et al,* 2010a). Organic arable fields may be most important as summer, winter, or migratory food resources (Dänhardt *et al,* 2010).

9.3 Annex 2.3: Habitats of Community importance that are associated with agriculture

Key / sources

Agriculture dependency according to Halada *et al* (2011) **Priority** = Priority Status according to Habitats Directive Annex I. **% N2K** = % of distribution spatially overlapping with N2K sites based on 2006 Article 17 reporting data (ETC/BD 2008)*. % UFC = % of habitat area* in Unfavourable Condition (for which condition was reported) based on 2006 Article 17 reporting data (ETC/BD 2008). * Excludes Romania and Bulgaria.

Code	Habitat	Priority	% N2K	% UFC
Fully dependent on agricultural management				
21A0	Machairs	1	?	100%
2310	Dry sandy heaths with *Calluna* and *Genista*		68%	100%
2320	Dry sandy heaths with *Calluna* and *Empetrum nigrum*		43%	100%
2330	Inland dunes with open *Corynephorus* and *Agrostis* grasslands		43%	100%
4060	Alpine and Boreal heaths		73%	23%
5120	Mountain *Cytisus purgans* formations		73%	0%
5210	Arborescent matorral with *Juniperus* spp.		65%	0%
5330	Thermo-Mediterranean and pre-desert scrub		69%	68%
6190	Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)		47%	63%
62A0	Eastern sub-Mediterranean dry grasslands (*Scorzoneratalia villosae*)		?	91%
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)		49%	63%
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	1	60%	15%
6230	Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in continental Europe)	1	37%	81%
6250	Pannonic loess steppic grasslands	1	39%	100%
6260	Pannonic sand steppes	1	33%	100%
6270	Fennoscandian lowland species-rich dry to mesic grasslands	1	22%	100%
6280	Nordic alvar and precambrian calcareous flatrocks	1	54%	53%
6310	Dehesas with evergreen *Quercus* spp.		65%	0%
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)		35%	98%
6440	Alluvial meadows of river valleys of the *Cnidion dubii*		52%	100%
6450	Northern boreal alluvial meadows		18%	100%
6510	Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)		46%	95%
6520	Mountain hay meadows		51%	100%
6530	Fennoscandian wooded meadows	1	54%	100%
9070	Fennoscandian wooded pastures		19%	100%
Partially dependent on agriculture				
1340	Inland salt meadows	1	51%	100%
1630	Boreal Baltic coastal meadows	1	71%	100%
2190	Humid dune slacks		51%	98%
2250	Coastal dunes with Juniperus spp.	1	67%	100%
4090	Endemic oro-Mediterranean heaths with gorse		62%	24%
5130	*Juniperus communis* formations on heaths or calcareous grasslands		30%	50%
5420	*Sarcopoterium spinosum* phryganas		85%	0%
5430	Endemic phryganas of the Euphorbio-Verbascion		79%	0%
6120	Xeric sand calcareous grasslands	1	18%	100%
6140	Siliceous Pyrenean *Festuca eskia* grasslands		90%	72%
6150	Siliceous alpine and boreal grasslands		58%	10%
6160	Oro-Iberian *Festuca indigesta* grasslands		68%	?
6170	Alpine and subalpine calcareous grasslands		64%	38%
6180	Macaronesian mesophile grasslands		86%	100%

6240	Sub-pannonic steppic grassland	1	67%	100%
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion)		65%	54%
7230	Alkaline fens		43%	97%
8240	Limestone pavements	1	47%	43%
Partially dependent but only for some sub-types or over part of the distribution				
1530	Pannonic salt steppes and salt marshes	1	55%	100%
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	1	57%	95%
2140	Decalcified fixed dunes with Empetrum nigrum	1	58%	93%
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	1	41%	99%
2340	Pannonic inland dunes	1	29%	100%
4020	Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*	1	41%	100%
4040	Dry Atlantic coastal heaths with *Erica vagans*	1	33%	63%
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	1	57%	56%
7210	Calcareous fens with *Cladium mariscus* and species of the Caricon davallianae	1	26%	72%

9.4 Annex 2.4: The use of habitats by butterflies in Europe (according to CORINE-biotope typology)

Source: adapted from van Swaay *et al* (2006) and updated Appendix 1 dataset

	Total number of species using habitat	Total number of European threatened species	Total number of HD Annex II	% threatened species
Natural & semi-natural habitats used for agriculture				
Blanket bogs	45	14	1	31.1
Raised bogs	48	13	4	27.1
Coastal sand-dunes and sand beaches	40	2	0	5.0
Inland sand-dunes	43	5	0	11.6
Heath and scrub	189	25	6	13.2
Sclerophyllous scrub	202	12	5	5.9
Phrygana	137	11	3	8.0
Dry calcareous grasslands and steppes	274	37	12	13.5
Dry siliceous grasslands	220	27	9	12.3
Alpine and subalpine grasslands	261	34	11	13.0
Humid grasslands and tall herb communities	171	27	13	15.8
Mesophile grasslands	223	39	17	17.5
Improved and intensive farmland & associated features				
Improved grasslands	74	1	0	1.4
Crops		[0	0	
Tree lines, hedges, small woods, bocage, parkland & dehesa	128	11	2	8.6
Orchards, groves and tree plantations	95	6	0	6.3
Other habitats				
Broad-leaved deciduous forests	186	25	14	13.4
Coniferous woodland	156	23	7	14.7
Mixed woodland	187	29	11	15.5
Alluvial and very wet forests and brush	100	15	5	15
Broad-leaved evergreen woodland	67	6	0	9.0
Cliffs and rocky shores	17	1	0	5.9
Water-fringe vegetation	75	15	6	20.0
Fens, transition mires and springs	59	15	6	25.4
Screes	88	7	4	8.0
Inland cliffs and exposed rocks	70	6	3	8.6
Urban parks and large gardens	96	5	1	5.2
Towns, villages, industrial sites	66	2	1	3.0
Fallow land, waste places	104	8	1	7.7

Note: Used habitats are those that support more than 5% of the population

9.5 Annex 2.5: Birds species listed on Annex I of the Habitats Directive that have significant populations with improved grassland and arable habitats in Europe

Habitat use: 1 = 10-75% of population in habitat at some point in annual cycle; 2 = >75% of population in the habitat.

Species	English name	Habitat use
Aquila heliaca	Imperial Eagle	1
Falco cherrug	Saker Falcon	1
Otis tarda	Great Bustard	1
Tetrax tetrax	Little Bustard	1
Anser albifrons flavirostris	Greenland White-Fronted Goose	1
Perdix perdix italica	Grey Partridge	2
Aquila pomarina	Lesser Spotted Eagle	1
Crex crex	Corncrake	1
Falco vespertinus	Red-Footed Falcon	1
Grus grus	Common Crane	1
Circus cyaneus	Northern Harrier	1
Ciconia ciconia	White Stork	1
Circus macrourus	Pallid Harrier	2
Elanus caeruleus	Black-Winged Kite	1
Emberiza hortulana	Ortolan Bunting	2
Lullula arborea	Wood Lark	1
Milvus migrans	Red Kite	1
Pluvialis apricaria	Eurasian Golden-Plover	1
Pterocles alchata	Pin-Tailed Sandgrouse	2
Pterocles orientalis	Black-Bellied Sandgrouse	2
Burhinus oedicnemus	Eurasian Thick-Knee	1
Perdix perdix hispanica	Grey Partridge	2
Pyrrhocorax pyrrhocorax	Red-Billed Chough	1
Calandrella brachydactyla	Greater Short-Toed Lark	2
Glareola pratincola	Collared Pratincole	1
Lanius collurio	Red-Backed Shrike	2
Lanius minor	Lesser Grey Shrike	1
Melanocorypha calandra	Calandra Lark	1
Branta leucopsis	Barnacle Goose	2
Buteo rufinus	Long-Legged Buzzard	1
Circus pygargus	Montagu's Harrier	2
Milvus migrans	Black Kite	1

9.6 Annex 2.6: A classification of the values of agricultural biodiversity in Europe according to their final benefits to humankind

Source: Adapted from Gantioler, Tucker and Kettunen (2008)

Key

Service type according to the MEA framework: S = Supporting, P = Provisioning, R = Regulating, C = Cultural.

Agriculture type: A = Arable, G = Grass (and other semi-natural habitats), P = Permanent crops, O = Orchards and olives, B = Biomass.

Agricultural component (AGRI COMP): C = Crop, L = Livestock, A = Associated species, LS = Landscape, E = Ecosystem.

Beneficiaries (BENEF): F = Farmer / landowner, V = Visitors, L = Local communities, C = Consumers, G = Global society.

Potential for substitution (SUBS): H = High, M = Medium, L = Low.

Relative value (with respect to typical agricultural intensity): H = High, M = Medium, L = Low, N = Nil.

BENEFIT	MEA	AGRI TYPE	AGRI COMP	BENEF	SUBS	Relative value				
						Natural	Semi-Natural	Improved grassland	Cultivated crops	Permanent crops
Food										
Arable crops (eg wheat, barley, oats, maize)	P	A	C	F,C,L	L	N	N	L	H	N
Vegetables (annually cultivated)	P	A	C	F,C,L	L	N	N	N	H	N
Herbs (cultivated)	P	A	C	F,C,L	M	N	N	N	H	N
Wild herbs / plants (foliage & seeds)	P	All	A	F,V	M	M	M	L	L	L
Wild fungi	P	G	A	F,V	M	M	M	L	N	N
Oils (rape-seed, linseed, sunflower)	P	A	C	F,C,L	L	N	N	N	H	N
Oil & fruit from olives	P	O	C	F,C,L	L	L	L	M	N	H
Grapes (wine & fruit)	P	P	C	F,C,L	L	N	N	M	N	H
Nuts & berries	P	All	A	F,V,L	M	M	M	L	L	L

BENEFIT	MEA	AGRI TYPE	AGRI COMP	BENEF	SUBS	Relative value				
						Natural	Semi-Natural	Improved grassland	Cultivated crops	Permanent crops
Perennial fruit (raspberries, strawberries, [melons])	P	P	C	F,C,L	M	N	N	N	N	L
Fruit from trees (orchards)	P	O	C	F,C,L	L	L	L	M	N	H
Livestock (meat & milk)	P	A,G,O	L	F,C,L	L	L	M	H	H	L*
Poultry (meat & eggs)	P	A,G,O	L	F,C,L	L	N	L	L	H	L*
Semi-domesticated animals (eg Reindeer)	P	G	L	F,C,L	H	M	N	N	L	L
Wild animals (game)	P	All	A	F,V,C,L	H	M	M	M	L	L
Materials										
Fibres from livestock (wool)	P	G	L	F,C	M	L	M	M	M	N
Fibres from cultivated plants (eg straw, flax, cotton)	P	A	C	F,C	M	N	N	N	M	M
Fibres from wild plants (eg reed for thatching)	P	G	A	F,V,C	H	L	L	L	N	N
Leather, skins, fur (hides) from livestock	P	A,G,O	A	F,C	M	L	M	M	M	M
Skins & fur from wild animals	P	All	A	F,V,C	H	L	L	L	L	L
Timber (eg trees in wood pasture, hedges & shelter-belts)	P	All	A	F,C	M	M	M	L	L	L
Cork	P	A,G,O	A	F,C	H	L	M	N	N	N
Oils	P	A	C	F,C	M	N	L	L	H	N
Other chemicals	P	A	A,C	F,V,C	M	L	L	L	L	L
Peat for horticulture	P	G	E	F,C	M	M	M	N	N	N
Water										
Clean drinking water, through water retention in soil	R	G	E	F,L	L	H	H	M	L*	L*
Energy										
Biomass (straw, *Miscanthus*, willow)	P	A	B	F,C	M	L	L	M	H	H
Biofuels	P	A	C	F,C	H	N	N	N	H	H
Firewood	P	All	A	F,V,C	M	M	M	L	L	L

BENEFIT	MEA	AGRI TYPE	AGRI COMP	BENEF	SUBS	Relative value				
						Natural	Semi-Natural	Improved grassland	Cultivated crops	Permanent crops
Dung for burning	P	G	L	F	H	L	L	N	N	N
Dung & waste for methane	P	A,G,O	C,L	F,C	H	N	N	N	L	L
Peat for burning	P	G	E	F,C,L	H	M	M	N	N	N
Property										
Avoidance of flood damage	R	G,P,O,B	E	F,L	M	M	M	L	N	L*
Avoidance of damage from severe wild fires	R	A,G	C	F,L	M	N	M	M	M	M
Avoidance of damage from extreme weather events related to climate change (carbon storage / sequestration)	R	G,O,B	C,E	G	L	H	H	L	N	L
Physical health										
Pharmaceutical crops	P	A	C	F,C	M	N	N	N	M	M
Pharmaceuticals / herbal remedies from wild plants / fungi	P	All	A	F,V,L	H	L	L	L	L	L
Avoidance of health impacts from floods	R	G,P,O,B	E	F,L	M	M	M	L	N	L
Avoidance of injury from landslides / rockfalls	R	G	C	F,V,L	M	M	M	L	N	L
Avoidance of respiratory diseases linked to air pollution (eg particulates) from hedge / tree-lines barriers	R	All	A	F,V,L	L	M	M	L	L*	L*
Avoidance of health impacts from water pollution (contamination)	R	G,P,O,B	E	F,L	L	M	M	L	N*	N*
Accessible open areas / stimulation for exercise	C	G,A	LS	V,L	L	H	H	L	L	L
Avoidance of health impacts of extreme weather events related to climate change (carbon storage / sequestration)	R	G,O,B	C,E	G	L	H	H	L	N	L
Psychological wellbeing										
Hedges and trees as visual barriers (eg from industry and	C	All	A	F,V,L	L	M	M	M	L*	M

BENEFIT	MEA	AGRI TYPE	AGRI COMP	BENEF	SUBS	Relative value				
						Natural	Semi-Natural	Improved grassland	Cultivated crops	Permanent crops
roads)										
Recreation (eg walking, mountain-biking, riding, skiing)	C	All	LS	V,L	L	H	H	L	L*	L*
Appreciation of the open landscape / green space	C	All	LS	F,V,L	L	H	H	M	L*	M*
Spiritual benefits	C	G	A,LS	F,V,L,G	L	H	M	L	L	L*
Appreciation of traditional / cultural landscapes (sense of place)	C	A,G,P,O	L,A,LS	F,V,L	L	N	H	L	N	L*
Appreciation / observation of wild nature	C	All	A	F,V,L	L	H	H	M	L	L
Appreciation of livestock (esp traditional breeds)	C	A,G	L	F,V,L	L	L	M	L	N	N
Collection of plants as ornaments (cut flowers / garden flowers)	C	All	A	F,V	H	M	M	L	L	N
Pets (horses, donkeys)	C	G	L,A	F,L,V	M	N	L	L	N	N
Appreciation of traditional rural activities involving wildlife (eg hunting)	C	All	A	F,V,L	M	L	M	M	L	L
Inspiration /subjects for art / photography	C	All	C,L,A,LS	V,C,L	L	H	M	L	L	L
Knowledge										
Research opportunities	C	All	All	G	L	H	H	M	M	M
Education opportunities	C	All	All	F,V	L	H	H	M	L*	L*

9.7 Annex 2.7: Agricultural trends and pressures on biodiversity

9.7.1 Analytical Framework - The DPSIR Model

The wider forces affecting biodiversity and the policy responses to address these, alongside other priorities, may be examined using a Driving Force – Pressure – State – Impact – Response (DPSIR) framework. This framework is used by the European Environment Agency to assess the relationship between the environment and socio-economic activities (eg EEA, 2010b; c), and is adapted from the Pressure-State-Response framework developed by the OECD (OECD, 1999).

Changes in biodiversity in agriculture are caused by a variety of economic, social, technological and policy drivers. These include exogenous drivers that are beyond the direct influence of policy (such as climatic factors, commodity markets, demographic trends and technological developments) as well as drivers that are endogenous to the CAP (including Pillar 1 and 2 support). These driving forces influence a variety of structural trends in agriculture and the wider rural economy that have implications for biodiversity, such as consolidation, intensification, extensification, abandonment and land use change. These are referred to as "pressures" in the DPSIR model but may have positive or negative effects on biodiversity. The direct effect of these pressures is to affect the area and quality of agricultural habitats, which in turn impact on the populations and diversity of species and the functioning of agricultural ecosystems. These impacts may result in responses by farmers and policy makers (which may include voluntary changes in management as well as changes in agri-environment and other policies), which in turn feed back through the driving forces effecting agricultural change.

The economic, political and environmental context within which the policy measures operate is not static. Agriculture has to face new challenges of climate change and resource efficiency, as well as to maintain economic viability in the face of global pressures. One of the key questions that emerges from this is how, in the future, Europe can meet its biodiversity targets, while simultaneously addressing these other problems. This question is central to identifying the most effective means of means of delivering biodiversity priorities in the future.

The linkages between agriculture, biodiversity, wider aspects of sustainability and the different drivers of change, vary between Member States and regions of the EU. Different regions face different socio-economic drivers, as well as varying policy objectives and priorities. Geographical differences also affect the competitiveness of agriculture and the way that it interacts with the rest of the economy. Differences in the state of agricultural development and restructuring between different regions also have implications for biodiversity and the different pressures that impact on it.

9.7.2 Structural changes in agriculture

EU agriculture continues to undergo a process of profound structural change, with significant consequences for biodiversity. Some of the key trends of relevance that have taken place in recent decades include:

- Specialisation;

- Mechanisation;
- Consolidation;
- Diversification;
- Intensification/extensification;
- New product and market development;
- Cost-cutting and labour saving;
- Adoption of new management systems (eg ICM, organic, min-till);
- Fragmentation of land holdings and reversion to semi-subsistence management;
- Abandonment; and
- Land use change.

These trends are of relevance for the relationship between CAP and biodiversity, in that, firstly, they impact directly on biodiversity, hence affecting the challenges and priorities for biodiversity conservation in agriculture in the EU; and secondly, have implications for policy measures designed to conserve biodiversity under the CAP. For example, the design, cost and uptake of agri-environment measures depends on the degree to which they are compatible with underlying trends in the agricultural sector.

The key trends in agriculture in the EU and their potential implications for biodiversity are examined in turn in the following sections, while Section 2.5 summarises forecasts of future trends based on the findings of studies examining future scenarios for EU agriculture.

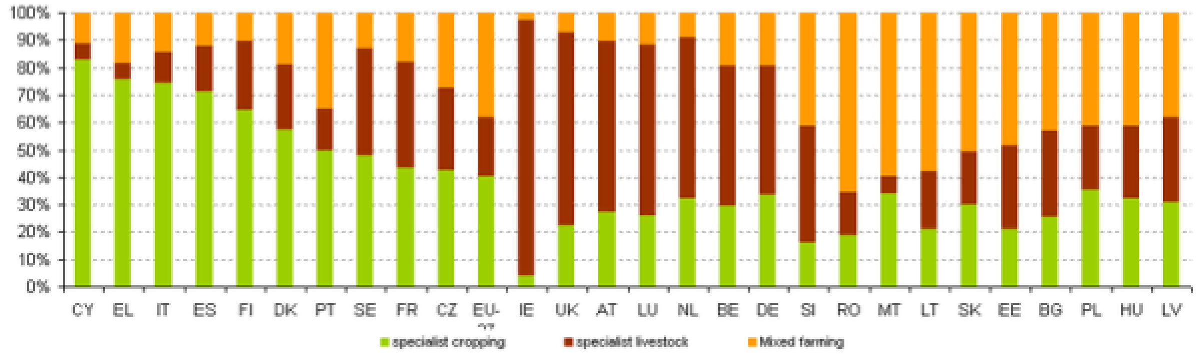
Specialisation
EU agriculture is becoming increasingly specialised, as individual farms and regions focus on the production of particular products. Traditional, mixed farms designed to supply a variety of outputs to local markets have been lost in many areas and replaced by more specialised cropping or livestock rearing enterprises where, typically, the products are sold further afield through national or international supply chains. This contributes to competitiveness and productivity by enabling particular regions to focus on products for which they have a comparative advantage, as a result of their climate, topography and soils. However, it may also weaken the sector's direct relationships with rural businesses and communities.

Eurostat (2010a) defines an agricultural holding as specialised when one particular activity provides at least two-thirds of the total Standard Gross Margin of the holding. Specialisation changes land use towards less diverse cropping and/or livestock patterns, due to more concentration on a limited number of products. A less diverse cropping/ livestock pattern may cause a loss of diversity in farmland habitats, as well as in associated flora and fauna, crop varieties and livestock breeds, leading to overall reduction of genetic diversity.

The distribution of crop-specialist, livestock-specialist and mixed-farming holdings remained rather stable between 2003 and 2007. In 2007 in the EU-27, 40 % of agricultural holdings were specialised in cropping (field crops, horticulture, permanent crops), 22 % in livestock (grazing livestock, granivores) and 38 % were mixed-farming holdings (mixed cropping, mixed livestock, mixed cropping/livestock). However, there is much diversity in combinations of specialised and mixed farming. In the Mediterranean and Scandinavian countries, specialist cropping is the dominant farm type. Specialist livestock is the dominant farm type in parts of Western Europe (ie Ireland, UK, Benelux, Germany). In most new

Member States, mixed farming is the dominant farm type (Eurostat, 2010a; Annex Figure 3). This suggests that a trend towards specialisation of farming systems may be expected in the new Member States over time.

Annex Figure 3: Specialisation of Agricultural Holdings in the EU, 2007



Source: Eurostat 2010

The effects of specialisation on biodiversity are illustrated by the Baden- Württemburg case study. Biodiversity in this region has been affected by a variety of trends reducing the diversity of the farmed landscape: a trend to cropping monocultures; intensive cutting of pastures; maize replacing grass driven both by dairy and biogas; concentration of production in most accessible areas; abandonment of more remote areas on the mountain slopes of the black forest; decline of transhumance customs; loss of traditional orchards due to low productivity – replaced with cultivated land and housing; decline of viability of steep slope vineyards due to inability to manage them with machines.

In the Czech Republic, specialisation has been observed on arable land, leading to a smaller number of crops, and on grassland, with farmers increasingly specialising in one type of livestock. These changes have been driven by profit maximisation linked to economies of scale and competition. In the lowlands this sometimes results in particular areas being dominated by hundreds to thousands of hectares of one crop, with adverse effects on wildlife.

In contrast, the Romanian case study highlights the importance of small-scale variation in management regimes, a complex mosaic of land uses and intensities, semi-natural grassland grazed by cattle and sheep in a shared system, hay in barns in winter, summer pastures nearby in summer. Specialisation was a widespread trend as agriculture was collectivized between the 1950s and 1980s, leading to loss of habitat and landscape diversity. For example, the specialisation of crop production in Southern Transylvania included barley, potatoes, sugar beet, hops and top fruit.

Mechanisation

Agriculture in the EU has become increasingly mechanised, with machines now used to complete many of the tasks previously undertaken by hand, reducing labour costs and enhancing productivity. This is a well-advanced trend that took place throughout the last half-century (longer in some countries), such that most EU-15 farms are now highly mechanised. However, in most of the eastern (and also in some southern) Member States and regions, where average farm sizes are small, the level of mechanisation is relatively low (Eurostat, 2010a). In certain parts of Central and Eastern Europe, tractors have not yet replaced horses and many tasks are still undertaken by hand. However, robust and reliable statistics on the rate of mechanisation for the EU-27 appear to be lacking.

Since the early 1970s, the CAP has supported mechanisation on farms through the provision of capital grants for farm modernisation and investments. These aids have been widespread and continuously used in a large number of Member States. Today, they form a significant share (around 10%) of the total funds devoted to rural development programmes across the EU-27, with markedly higher proportionate use in the new Member States and a few of the EU-15 (Belgium, in particular – Dwyer *et al,* 2008).

Mechanisation does not necessarily harm biodiversity but may facilitate land improvement, the removal of unfarmed features, and the development of larger, more concentrated or more intensive production systems (such as indoor livestock units generating liquid waste rather than solid manures, or large-scale cereal farming where pesticides replace labour as the main method of weed control). Mechanisation can provide a direct threat to some wildlife, such as nesting bird species[44].

Again, the case studies highlight marked differences between the agriculturally modernised regions and less agriculturally developed Member States such as Romania. In the Czech Republic, modernisation of already mechanised agriculture has led to use of more efficient and usually heavier machinery, bringing faster harvesting of grasslands and often causing soil compaction. This trend is driven by profit maximisation and is believed to have brought a decline in biodiversity on grasslands. In England, agricultural systems are already highly mechanised with only very traditional / artisan management in isolated areas being carried out by hand (eg traditional reed cutting in Norfolk). One possible trend is the creation of 'super dairies' such as the proposals for a 3,770 (previously 8,000) cow dairy farm at Nocton Heath, Lincolnshire, in which cattle are raised indoors for six months of the year and rely on feed rather than grass fed lifestyles. The effect of super dairies, or the move to more feed based milk production and indoor rearing means less semi-natural grazing, a traditional farming system important for a range of grassland habitats of much of the country. Advocates of such dairies suggest that more land could be freed up for biodiversity or environmental purposes by the concentration of animals into smaller areas.

In contrast, subalpine hay meadows in Southern Transylvania are typically fertilised only with livestock dung and are mown by scythe. The steepness of many slopes and the high cost (relative to income) of fuel, machinery and chemical fertilisers prohibit the intensification of winter fodder production and the purchase of concentrates.

[44] Eg Corncrake, Crex crex, which has been affected by the move from hand scything or horse-drawn mowing to mechanised cutting of fields. http://ec.europa.eu/environment/nature/natura2000/management/docs/Crex%20crex%20factsheet%20-%20SWIFI.pdf

Consolidation
There is an ongoing decline in the number of farms in the EU, with agricultural production being concentrated among a smaller number of units of larger average size. This helps farms to benefit from economies of scale, contributing to competitiveness.

The number of agricultural holdings in the EU27 declined by 9% from 15.0 million in 2003 to 13.7 million in 2007, with the average size increasing from 11.5 ha to 12.6 ha over this period. There were particularly rapid structural changes in Estonia, where the number of holdings declined by more than one third (-36.7 %), as well as in Bulgaria (-25.9 %), Portugal (-23.4 %) and Hungary (-19.0 %) (Eurostat, 2010a). These average values mask significant regional diversity reflecting differences in natural conditions and farming systems, such that commercial farms in some of the most productive arable regions may exceed several thousand hectares, whilst in other more pastoral or semi-subsistence farming areas, farms of only 2 to 5 hectares would be the norm. Very large farms are also a feature of some upland and marginal areas, for example in the UK and Czech Republic.

The case studies and statistical evidence suggest that consolidation is an ongoing trend throughout the EU, but is more advanced in some regions than others. In some Member States such as Romania, where agriculture is at an earlier stage of development, and where many farmers are part time and pluriactive, average farm sizes remain very small. In many parts of Central and Eastern Europe, trends in farm size have been profoundly affected by political and institutional changes (eg collectivisation and subsequent restructuring). In the Czech Republic, average farm size remains large, despite a decline since the 1990s, with 71% of the agricultural area made up of farms of more than 500 hectares. Large farm size is also associated with large fields - it is estimated that almost 40% of the land area is made up of fields of more than 50 hectares, and there is a paucity of traditional field boundaries, with clear implications for habitat structure.

In contrast, typical holdings in Southern Transylvania, Romania, are between 3ha and 4ha in size, and 45% are small holdings of less than 1 hectare, too small to be included on the national farm register and effectively outside of the policy framework for agricultural and rural development support. Small-holdings are characterised by a highly fragmented and fine-scaled mosaic of land tenure, commonly with a few small parcels of meadow, cultivated land, vegetable gardens and orchard close to the household whilst other parcels are much more widely scattered. Around 80% of all agricultural holdings keep more than 50% of their produce for home consumption and cannot therefore be described as commercial.

In France, it is estimated that 15 million hectares of land have been consolidated since 1945. This, coupled with a decline in permanent grasslands, has led to the loss of hedgerows, which decreased from approximately of 2 million km at the beginning of 20th century, to 1.244 million km in 1960, and 707,000 km in 2000. In England, there has also been a trend towards increasing average size of holdings, which reached 47.4 hectares in 2007 (Defra, 2010), driven by the pursuit of economies of scale. However, there has also been rapid growth in the number of part time and hobby farms (very small holdings below 8 ESU), while the average size of farms of more than 8 ESU has increased to 112.7 ha (Defra, 2010). The enlargement of holdings has been linked to a decline in the number of hedgerows and other boundary features.

In Baden-Württemberg , structural changes in agriculture in the last 60 years (Seitz, 2008) have included a decrease of the number of agricultural holdings from 215,430 in 1971 to 57,049 in 2007, and a corresponding increase of the average farm holding size: 4.9 ha in 1949 to 23.9 ha in 2005. This is relatively small compared to the national average.

In the EU 15, there was a 16% decline from 6.8 million holdings in 2000 to 5.7 million in 2007, with the average size increasing from 18.7 ha to 22.0 ha over this period (European Commission, 2011a).

Consolidation is not in itself necessarily harmful to biodiversity, but it may be accompanied by other structural changes such as specialisation of production, the loss of labour for management, and the removal of unfarmed habitats. In particular, the frequent combination of consolidation and specialisation can exacerbate the negative impacts discussed for specialisation, above. An additional consequence of the combination of mechanisation, specialisation and consolidation is the spatial concentration of high levels of potential pollutants from agriculture – such as manures and slurries from livestock farming, or pesticides, soil particles and chemical fertilisers from arable farming – which can greatly increase the risk of environmental damage from farming activity.

Diversification

The pressure to increase farm incomes when farmgate prices remain relatively low, accompanied by the growth in rural population and rural markets including tourism and leisure, has encouraged many farms to diversify and to develop new business enterprises. Farm diversification can be defined as the creation of any gainful activities that do not comprise any farm work but are directly related to the holding. This may include, among other things, tourism, accommodation and other leisure activities, handicrafts, processing of farm products, wood processing, aquaculture, production of renewable energy for the market, and contractual work using the equipment of the holding (European Commission, 2008b).

Only a minority of EU farm holdings are diversified, with only 12% of EU-27 holdings carrying out a gainful activity outside agriculture in 2005. The share of farms with a diversification activity ranged from 1% in Lithuania to 29% in Finland. Diversification is more widespread in Western and Northern Europe – especially in Finland (29%), France (25%), UK (24%), Germany (22.5%), the Netherlands (22.5%), Austria (21.4%), and Denmark (18.4%) - and is less developed in Eastern and Southern Member States as well as in Ireland (European Commission, 2008b). These estimates are lower than some others, because of the relatively narrow definition used – diversification is defined as including only activities directly related to the holding and excludes businesses not related to the holding itself, as well as off farm activities.

The most popular diversification activity involves adding value to agricultural products, practiced on 56% of the holdings with diversification. Contractual work is undertaken by 11.3% of the holdings with diversification, while farm tourism is present only on 4% of farms with a diversification activity in the EU-12 and slightly fewer than 20% in the EU-15. The same report estimated that the proportion of farms with diversification increased from 8.7%

to 10.0% between 2003 and 2005. It also estimated that 36% of the managers of family farms of EU-27 were involved in another form of economic activity off-farm in 2005, with pluriactivity more widespread in the Northern and Eastern Member States than in the Western and Southern ones (European Commission, 2008b).

The case studies confirm that rates of diversification vary widely between regions. In the Czech Republic, diversification is considered relatively rare, though there is some on-farm processing and a rapid increase in the production of biogas, which is supported under the RDP, and usually linked to the production of maize (Ministerstvo zemědělství 2010). In contrast, agriculture in Southern Transylvania is characterised by very small holdings, engaged in semi-subsistence farming. Because a large proportion of production is consumed rather than sold, these holdings rely heavily on other sources of income.

Baden-Württemberg has traditionally a high share of part-time farmers, mainly located in the low mountain ranges, areas with a specific form of heritage law (subdivision of plots, *de facto* splitting), as well as special or intensive cultures. The share of part-time farms has steadily increased over the past years across almost all sizes of holdings and regions. Full-time farming is mainly decreasing in areas which have to be cultivated under difficult natural conditions. In 1949 there were 251,000 full-time and 141,000 part time farms; in 2005 there were 19,900 full-time and 35,400 part time farms.

Diversification may have positive effects on biodiversity by influencing land management practices – for example where a positive environmental image is projected in product marketing, or where environmental enhancements are used to attract visitors. Alternatively, diversification can lead to the creation of businesses that are less sympathetic to biodiversity, for example involving intensive recreational use of land. Another potential impact of diversification can be the creation of an incentive for quality, rather than quantity, in a farm's strategy for competitiveness, leading to a relative extensification of production or a decision not to intensify which is against the prevailing trends. This has been observed in a number of studies, in recent years.

Intensification/extensification

Intensification of agriculture involves the increased use of farm inputs (excluding labour or land) to increase output per unit area. This may be achieved, for example, through increased use of pesticides and fertilisers, higher stocking rates, drainage and/or reseeding of grassland, introduction of irrigation for permanent, horticultural or arable crops, and higher utilisation of the land on farms (for example by cultivating previously fallow areas or removing unproductive features, so increasing the utilised agricultural area). These trends are largely deleterious to biodiversity, reducing the variety of plant and animal species supported by agricultural habitats. In the past, high levels of price support under the CAP regimes for arable crops, dairy products and beef in particular are regarded as having encouraged the intensification of agriculture, by increasing the relative returns from higher-input farming systems (Baldock *et al,* 2002). Subsequent cuts in price support, followed by decoupling of support from production, have reduced the policy-driven incentive to intensify (although market price trends may also encourage or discourage this), while the agri-environment programme has encouraged the retention or reintroduction of more extensive farming practices in many areas.

Eurostat (2010a) classifies farms into three intensity categories, low, high and medium, according to the level of input expenditure on pesticides, fertilisers and animal feeds per hectare of utilised agricultural area (UAA). The process of intensification is defined as an increase of the share of UAA managed by high-intensity farms and/or a decrease of the share managed by low-intensity farms. Extensification is characterised by a decrease in the former and/or an increase in the latter. Trend differ for the old Member States (EU-15) and the new Member States (NMS-10) over the period 2004–2007 which covers the implementation of the 2003 CAP reforms for EU-15 and the enlargement of the EU in 2004, but ends before the significant rise in agricultural prices that began in 2008. Extensification was very slight but continuous in the EU-15, whereas marked intensification took place in the NMS-10. However, the input expenditure per hectare was much lower in the NMS-10 than in the EU-15: the share of UAA managed by high-intensity farms rose from 11% to 16% in the NMS-10 and slightly decreased from 32% to 31% for the EU-15. At the same time, the UAA managed by low-intensity farms fell from 55% to 47% in the NMS-10, while it increased from 32% to 36% in the EU-15. This picture reflects the generally less advanced state of agricultural development in the new Member States. However, there are exceptions, such as parts of the Czech Republic, where agriculture is relatively intensive.

In Romania, semi-natural grasslands remain relatively widespread with an estimated national area of 2.4 million hectares (MAFRD, 2009). The extensive occurrence of these habitats is an indication of the continued presence of low-intensity agriculture, which can be characterised by low nutrient inputs and low outputs of products per hectare (Bignal and McCracken, 2006). These are rich in biodiversity and classified as HNV farming systems. Agriculture in Southern Transylvania is dominated by traditional pastoralism which typically involves very low intensity grazing of large areas of semi-natural grassland and extensively-managed subsistence/semi-subsistence small-holdings. Subsistence farming creates a living, dynamic agricultural landscape which is steeped in culture and history, and delivers biodiversity and other environmental benefits. Large areas of extensively managed semi-natural pastures and meadows in Southern Transylvania make the region particularly rich in biodiversity, including many flora and invertebrate fauna species of national and international conservation concern. In Romania, 71% of all holdings are categorised as subsistence farms by Eurostat (RMARD, 2009). The low intensity pastoral systems predominating in Southern Transylvania are rich in biodiversity, and tend to be characterised by well-established management practices (traditional management of hay meadows and the seasonal movement of grazing livestock), very limited use of fertilizers and pesticides, very low stocking densities, a low degree of mechanization and high levels of labour input. However, it is anticipated that semi-natural grasslands in the uplands, particularly on more gentle slopes, will be impacted by the intensification of land use practices, a trend that has to date mainly been limited to the lowlands of Romania (Sârbu *et al,* 2004; Schmitt and Rákosy, 2007).

In England, biodiversity has been affected by a continuing process of intensification in recent decades. Between 1932 and 1984 there were substantial losses in both agriculturally unimproved lowland pasture and chalk grassland, which declined by 97 and 80 per cent respectively. Of the 7 million ha of managed agricultural grasslands in Great Britain, less than 0.3 million ha are unimproved and calcareous grasslands (Countryside Survey, 2007)

In France, intensification of management and simplification of agricultural practices in the last 50 years have resulted in significant modification of habitats, including removal of hedgerows, drainage of wetlands and conversion of extensive grasslands into field crops. This resulted in an opening of the landscape in 19 per cent of the situations between 1992 and 2002 (Lee and Slak, 2007), leading to a loss of landscape features, such as hedgerows. According to Pointereau *et al,* (2010), the HNV farmland area is estimated to have declined to 6.9 million hectares in 2000 compared to 21.3 million hectares in 1970, a decrease of 68 per cent in 30 years. The greatest decline has been in western France.

In the Czech Republic, there was a marked intensification of agriculture between 1950 and 1990, with large increases in inputs and machinery use, a trend towards indoor rearing of cattle, and structural changes such as drainage of wetlands, ploughing of grasslands and enlargement of fields. However, variations in the rate of intensification meant that biodiversity declined sharply in many areas, while others remained relatively rich in biodiversity (Pražanova 2005). In the 1990s, numbers of cattle and sheep steeply decreased while outdoor grazing of cattle increased, while significant areas of grassland faced a threat of abandonment. Input use on both arable and grassland decreased significantly (Pražanova 2005). Some new landscape elements were created in the process of reparcelling during the 1990s and after 2000. After EU accession, support under the CAP (including agri-environment measures) has reduced the risk of abandonment and input use has risen slowly (Ministry of Agriculture 2010), but has remained rather low on grassland as a result of high uptake of agri-environmental measures (Ministry of Agriculture 2010). Continuing changes in land use were also observed between 2008 and 2009, with a decrease of arable land by 12,550 ha and increase of grasslands by 11,410 ha (Ministerstvo zemědělství 2010), continuing a trend observed during the last 10-15 years.

In Greece, the area of irrigated land is seen as a key indicator of intensification (Beopoulos, 1996), since it is accompanied by increased agrochemical use as well as usually specialisation of production. The irrigated area in Greece increased by 25% from 938,000 ha in 1990 to 1.17 million ha in 2000 (National Statistical Service of Greece, 1995 and 2005).

Recent trends at the EU level indicate that:

- The use of fertilisers and soil improvers declined between 2000 and 2009, with a 35% decline in the volume index for the EU-15. A 24% decline was recorded in the EU27 between 2002 and 2009. Most Member States recorded a decline in this period, but there were increases in some of the new Member States, especially between 2000 and 2005 (European Commission, 2011b);
- The use of crop protection products was relatively stable at EU level between 2000 and 2009. The volume index for the EU-15 declined by 0.5% over this period while that for the EU27 increased by 4.1% between 2002 and 2009. Some Member States, especially in Central and Eastern Europe, recorded rapid growth in this period (European Commission, 2011b).
- The total irrigable area in the EU27 fell by 8.2% and the actual irrigated area by 6.5% between 2004 and 2007 (Eurostat, 2010b).

Some literature indicates a likely trend of putting more marginal land to intensive agricultural use in new Member States, and the policy debates frequently invoke this trend as opportunity for food production and climate change mitigation (Stoate, 2009; EEA, 2010). The likely rapidity and the extent of such changes across the new Member States may depend on the availability of suitable marginal land as well as on the interplay of policy incentives and exogenous drivers. The varying constraints upon the potential to intensify marginal land in different regions, related to the varying environmental, biophysical, agronomic, and climatic conditions, will play a role too. The trend would not always be recorded in official land use statistics, or captured through existing intensification parameters because it may involve more basic cropping changes (eg introduction of maize on unused marginal land). For example, the 2010 expert review of national renewable energy plans noted, for example, that the Romanian authorities declare 3 million of unused arable land as possible to be mobilised for biomass production (Atanasiu, 2010).

New product and market development
The development of new agricultural markets, such as those for energy crops, can be expected to directly affect the structure and diversity of agricultural habitats. This may potentially enhance habitat quality and diversity in some areas and reduce it in others, particularly if new crops replace previously biodiverse farming systems. The area of energy crops in the EU-27 had grown to 1.315 million hectares by 2008, of which 64% was oilseed rape. Short rotation forest trees totalled only 19,375 hectares, according to data supplied by Member States (European Commission, 2011a).

An interesting theme emerging from two of the case studies (Germany, the Czech Republic) relates to the impact of bioenergy targets, and the role that rapid development of bioenergy markets plays in driving cropping changes, specialisation, and land use change. For example in Germany the political and economic investment in expansion of renewable energy markets through incentives provided by the Renewable Energy Sources Act (EEG) prompted a significant increase in intensive maize production (now covering six per cent of arable land) and resulted in the ploughing up of grasslands. Biomass production is expected to increase further in future, with negative impacts on biodiversity, as it usually leads to maize monoculture, intensive production and ploughing up of grassland.

The Czech case study notes that 'farmers are using fertilised grass from improved pastures (previously unimproved) to feed local biogas plants' and other perverse effects are observed with support for photovoltaic cells (PV) leading to large areas of sometimes fertile land being covered and lost to production. These trends are not highlighted in the UK study, however bioenergy markets are highlighted as having potential (negative) effects on biodiversity in the future for the same reasons as those observed in Germany and the Czech Republic.

Cost-cutting and labour saving
The challenge of maintaining farm incomes has required farmers to minimise input costs, including by reducing labour inputs per farm or per hectare. As a result, and particularly when seen in combination with consolidation, mechanisation and specialisation, the EU's agricultural labour force has declined steadily over time. Reducing labour may have negative consequences for biodiversity, by reducing the time available for the management of habitats and farmland features, as well as the careful handling of grazing livestock systems

and the management or safe disposal of farm wastes. For example, in the Czech Republic, it was noted that a decline in small scale farming and a contraction of the agricultural labour force has made it difficult to hire labour for some traditional management practices, such as hand mowing of grass in areas inaccessible to machinery.

The EU agricultural labour force continues to decline at a significant rate, continuing trends in recent decades. The total EU-27 agricultural labour force declined by 25% from 14.95 million annual work units in 2000, to 11.22 million in 2009 (European Commission, 2011a).

Adoption of new management systems (eg ICM, organic, min-till)
Recent years have seen the introduction and growth of new management systems designed to reduce inputs and enhance agriculture's impact on the environment and animal welfare. Organic farming has grown rapidly across the EU and there has been growth in new methods such as integrated crop management and min-till which are designed to enhance the performance of conventional systems. These systems have often been shown to be beneficial to biodiversity. At the same time there has been increasing concern for animal welfare in agriculture, leading to growth in free range systems for pigs and poultry.

The area of organic land certified or in conversion increased from 4.9 million hectares in the EU27 in 2001 to at least 8.6 million hectares in 2009, an increase of 75% (European Commission, 2011a). Figures for 2008 indicate that organic production ranged from 0.3% of UAA in Bulgaria to 12.1% in Austria, and averaged 4.8% in the EU-15 and 2.7% in the EU-12. There are, however, wide variations between Member States, making it difficult to detect clear patterns across the EU[45].

While also growing in extent, other management systems still account for only a small proportion of agriculture in the EU – for example, ICM was estimated to be applied in less than 3% of the EU's agricultural area in 2002, with the largest area in the UK at 1.5 million hectares (Agra CEAS, 2002).

All of the case studies cite organic production as an important part of the agricultural system and one that delivers across a range of objectives and receives wide uptake, eg in Greece uptake of organic production was 300 per cent of that initially planned. There are further good examples of win win[46], and win win win[47] scenarios in France, Germany, UK, although these are exclusively driven by either large private organisations (eg Lu Harmony in France and SCaMP in UK), demonstration projects (eg Life+), large interested landowners (eg National Trust UK), or diversification (eg Weidemilch and 'Bionade' in Germany).

Fragmentation of land holdings and reversion to semi-subsistence management
Especially in the new Member States, farms have been split up as a result of land ownership and institutional changes and the need to accommodate the ex-urban unemployed returning to the family farm. Major economic restructuring has taken place in the EU-12 and new Länder in Germany, following the collapse of planned economies. This is largely a

[45] Rural Development in the European Union - Statistical and Economic Information - Report 2010

[46] Environmental and Economic

[47] Environmental, Economic, and Social

feature of the 20 years from 1990 onwards, but its impacts are still very evident and the resulting structures persist due to lack of alternative opportunities for employment, in some areas. The impacts on biodiversity are likely to be mixed.

Official statistics indicate that, while the number of holdings declined in most of the new Member States between 2003 and 2007, indicating a process of consolidation, there was an increase in Poland. The number of holdings increased from 2.17 million to 2.39 million over this period, with almost 200,000 additional holdings in the 0-5 ESU size group (European Commission, 2011a).

The same statistics highlight the small average size of holdings in the new Member States compared to the EU average. For example, the average farm size is recorded to be 6.2 hectares in Bulgaria, 3.6 hectares in Cyprus, 6.0 hectares in Hungary, 0.9 hectares in Malta, 6.5 hectares in Poland, 3.5 hectares in Romania and 6.5 hectares in Slovenia compared to 12.6 hectares in the EU-27 and 22 hectares in the EU-15. In contrast, large (co-operative and corporate) farms continue to predominate in the Czech Republic, with an average farm size of 89 hectares (European Commission, 2011a).

Collectivisation took place between the 1950s and 1980s and had negative consequences for biodiversity, largely due to the ploughing of large areas of intact, semi-natural grasslands (Sârbu *et al,* 2004); the specialisation of production with an associated loss of habitat and landscape diversity; and the intensification of production and associated increases in the use of mechanisation and agrochemicals. Most of the small-scale farms currently found in Southern Transylvania were formed during the first phases of post-communist transition in the early 1990s when there was an immediate increase in the number small farms following the privatisation of the former state agricultural enterprises and the restitution of land to the original owners (Pieniadz *et al,* 2009). Since this also coincided with a marked decline in industrial output and the release of many workers from industrial enterprises in the region (plus many urban migrants fleeing unemployment and poverty in the cities), a large number of unemployed people were rapidly absorbed into subsistence agriculture. Most of the land transferred went to elderly people, whilst the remainder went to younger, but generally poorer, rural households. The restitution process resulted in small, fragmented plots averaging around 2 ha in size and split into several parcels (often with multiple owners) – effectively re-creating a small-scale subsistence and semi-subsistence farm sector that accounted for over 65% of all agricultural land.

The breakdown of the former state agricultural enterprises and the fragmentation of land ownership led to a significant slump in productivity, but was very positive for biodiversity. This was due to various factors, including:

- a reduction in the intensity of land use (namely very limited use of fertilizers and pesticides, and much lower low stocking densities);
- restoration of the traditional fine-scale mosaic landscape, including an increase in uncultivated field margins and plot boundaries, and;
- a decline in the level of mechanisation.

As the number of small-holdings and area under subsistence agriculture increased, the traditional links between subsistence small-holdings and pastoralism quickly became re-established. Professional shepherds from the local villages continued to take sheep and cattle to the mountain pastures for summer grazing, but collected the animals from private households (as a communal flock/herd) rather than from the collective farm.

Abandonment

Agricultural abandonment can be defined as the complete withdrawal of agricultural management such that natural succession processes are able to progress (IEEP, 2010). Low farm incomes in many parts of the EU and the increasing marginalisation of less productive agricultural land have led to concerns that farmland will be increasingly abandoned. High nature value farming systems – which tend to be extensively managed and have relatively low productivity – are often most at risk – leading to concerns that biodiversity will be lost.

The extent of agricultural abandonment is difficult to measure systematically and is not dealt with by official agricultural statistics – changes in Utilised Agricultural Area can be measured but reductions may be caused by other factors such as afforestation and urbanisation, as well as abandonment. More importantly, where land is no longer actively managed but is still part of larger holdings upon which production continues elsewhere, this will not be recorded in any official statistics. An additional reporting difficulty relates to land abandonment (and a risk of biodiversity decline) potentially associated with those farm holdings that are difficult to reach in HNV areas in the EU-12 that are included in the Eurostat agricultural statistics but not necessarily registered for direct payments. The areas outside direct payments may account for quite a significant proportion in some new Member States, for example, 16 per cent in Slovakia in 2008 (Čierna-Plassmann, 2010).

A recent study by IEEP (2010) concluded that, over the last few decades, there have been significant but variable levels of farmland abandonment in Europe, primarily in areas where agriculture is less productive, particularly in remote and mountainous regions and areas with poor soils and harsh climates. For example, annual losses of Utilised Agricultural Land of 0.17% in France and 0.8% in Spain were recorded from the late 1980s to the end of the 1990s, though some of this land may have been converted to forestry rather than merely abandoned (Pointereau *et al,* 2008). In eastern Europe widespread abandonment occurred as a result of the political changes at the end of the 1980s, with abandonment estimates of 15-20% of cropland in Slovakia, Poland and Ukraine. However, some anecdotal observations suggest that significant areas of recently abandoned land have since been returned to agricultural production in the EU-12. At the same time, there have been some studies suggesting a trend towards 'super-extensification' or virtual abandonment of marginal areas in the EU-15, in recent years (eg Gaskell *et al,* 2010).

Abandonment was identified as either an existing trend or a threat in most of the case studies, mostly affecting particular locations. In the Czech Republic, there was widespread abandonment of agricultural land in the 1990s but this process was reversed after EU accession, and now there is nearly no abandoned land. However, natural conditions continue to limit production in some areas, with the threat that abandonment may occur in future.

In England, in the upland and more marginal areas of the north and south west of the country abandonment and fragmentation of farming has been one of the major threats influencing biodiversity and the wider rural environment. These traditionally low productive livestock systems under coupled payments benefited from support and as a consequence maintained artificially high production resulting in overgrazing of semi-natural grasslands and moorland systems. Since decoupling stock numbers have reduced dramatically removing much of the pressure on the upland environment however under stocking and or abandonment through lack of profitability is now an issue in some areas resulting in the under grazing and the scrubbing up of traditional and valued landscapes. Agri-environment and other policy measures have been used to maintain the appropriate levels of stock on land. This coupled with the SFP provide a much-needed source of income for upland farmers.

There is no detailed information on the rate or extent of land abandonment in Romania but the trend is highlighted as a threat to the conservation of semi-natural habitats in mountain regions (Baur *et al,* 2006; Schmitt and Rákosy, 2007; RMARD, March 2007). However, because the movement of livestock for summer grazing is widespread, much abandoned land may continue to be used for agricultural purposes because although there is no active occupant/land manager, the land is regularly grazed by passing shepherds – indeed, abandoned land and other "unfarmed" features (such as grassy margins, terrace banks, ditches etc.) are important sources of grazing for landless shepherds (and also winter forage eg it is common to see people mowing roadside verges and other uncultivated patches for hay) (Redman, 2009). In February 2011, RMARD communicated that a surface of 1.4 million hectares of land, mostly in the SE of the country, has been identified as being "unfarmed" and could be subject to penalties if the owners continue to leave it unmanaged (Radulescu, RMARD, 2011). Most notable is the increasingly common abandonment of hay-making, beginning with the less accessible meadows in the mountain areas, and the subsequent encroachment of shrubs and bushes into these meadows clearly reduces species diversity and abundance in the semi-natural grasslands. The abandonment of cultivated plots is also common, although this is likely to have biodiversity benefits due to the increased habitat heterogeneity and (in the longer-term) gradual succession towards grasslands. All of which will have a positive impact on populations of birds and small mammals; increased species richness with arable wildflowers, wild relatives of fodder crops and forage legumes, and; development of more complex ecosystem with pollination systems etc.

In Baden-Württemberg increasing land abandonment occurs in extensively used and often less favoured areas. Subsequent scrub invasion leads to the loss of food for many pollinating insects. The decoupling of the pillar one subsidies has tended to result in a decline of utilization by cattle and sheep which will lead to a release of grassland, especially on steep slopes. Most of these steep areas are located in the low mountain range of the Black Forest, where the share of forest is already substantial. There is a trend to afforest agricultural land, often species-rich grassland, in parts of the black forest with negative consequences for biodiversity and landscape (MEKA III in MEPL II).

Land use change to non agricultural uses

There is a continuing but slow trend towards the conversion of agricultural land to other uses, through urbanisation and afforestation. This affects a small proportion of the overall agricultural land area, but has a cumulative effect over time. Land use change clearly has consequences for biodiversity, replacing farmland habitats and species with others – the overall consequences depend on the relative habitat value of the previous and new land uses. A review by the European Environment Agency (2010b) of land use trends in Europe between 2000 and 2006 identified a net decrease in the area of arable land and permanent crops of 0.2% and a decline in the area of pasture and mosaics by 0.3% over this period. The main increase in land use was for artificial areas (urban areas and infrastructure), showing a net gain of 6,258 hectares, or 3.4%. A slight increase in the annual rate of urbanisation was noted compared to the period 1990-2000.

European Commission (2011a) statistics indicate only a marginal reduction in the Utilised Agricultural Area on holdings from 172.8 million hectares in 2003 to 172.5 million hectares in 2007 in the EU27. In the EU-15 there was a 1.8% reduction from 126.8 million hectares in 2000 to 124.5 million hectares in 2007. Some of the new Member States recorded an increase in UAA between 2003 and 2007 – including Bulgaria, Estonia, Latvia and Poland – perhaps as a result of previously abandoned land being brought back into management.

In 2007, 2008 and 2009, the EU made payments for the afforestation of 38,053 hectares of agricultural land under new agreements (Regulation 1698/2005 art. 43) and 1,048,835 hectares under commitments from previous programming periods (European Commission, 2011h).

Pressure on biodiversity from development is particularly prevalent in more prosperous rural and urban fringe areas and less so in more remote regions. For example, farmland biodiversity in Baden-Württemberg is affected by high rates of land consumption for infrastructure (settlements and transport). From 2000 to 2010 the agricultural area decreased by 2.9 %. Fragmentation of landscape and isolation of habitats through roads and other infrastructure is also a concern. The area occupied by settlements and transport infrastructure increased by 12.6% between 1993 and 2009, while the forest area is also increasing. This has been mainly at the expense on agricultural area which has decreased by 5% in the same time. This amounts to a daily loss of 14.1 ha of agricultural land in the given time period.

In France, there has been a steady conversion of agricultural areas into artificial areas, which is expected to continue at a rate of approximately 60,000 ha per year in the future (MEED, 2010b). In Southern Transylvania, there is a trend towards local people selling accessible parcels of meadow and pasture land for the construction of holiday homes and guesthouses. This is increasingly common in certain parts of Southern Transylvania, including protected areas such as the Piatra Craiului National Park, and contributes to the erosion of semi-natural grasslands and associated species diversity and abundance.

9.7.3 Driving forces affecting Agriculture

The drivers of intensification and marginalisation exogenous to the CAP have been identified in several recent studies at EU and national levels (IEEP & Alterra, 2010; Keenleyside and Tucker, 2010). Their findings indicate that these drivers interact with each other in complex and dynamic ways and over varying timescales, and the response of farmers is very context specific. Similar combinations of drivers can produce quite different responses, depending on the farming system, the farm structure (including the availability of additional factors of production – land, labour and capital), the biophysical conditions (soil, slope, altitude, and climate) and social circumstances. These factors may lead to significant changes in land uses, thereby affecting threats to biodiversity, as considered above.

The key drivers associated with the most significant impacts on land use intensification in the EU over the next 25 years to 2030, as they have been identified in the study for DG Environment (the 'Land services' report - IEEP and Alterra, 2010), are also likely to be relevant for assessing the impacts of agriculture on biodiversity. They are:

- Agricultural commodity markets, which affect land use decisions, farm profitability and the intensity of production. Trade liberalisation is a key determinant of future market conditions;
- Markets and policies for renewable energy, which affect the supply of energy crops and the use of land for renewable energy generation, and therefore influence land use decisions and management practices;
- Social and demographic change, affecting the structure of rural communities and the size and structure of the agricultural labour force;
- Climate change – which is expected to affect land use, land and water management, growing seasons and yields; and
- Technological developments – which contribute to the challenge of achieving food security and affect land use and land management practices.

Studies suggest that a variety of factors will act on the development of agriculture in the EU in the next 20 years, and that these can be expected to have a range of positive and negative influences on biodiversity. In particular:

- Growth in demand for food and energy crops is expected to increase EU production and encourage further intensification and specialisation, particularly in the new Member States. The viability of some HNV farming systems may be enhanced, while others will be threatened by increased competition from imports as well as social changes in rural areas, or face pressure from intensification or changes in land use. In addition, biodiversity in the generality of the farmed countryside, outside HNV areas, appears likely to decline in these Member States.
- Climate change will affect land use and agricultural management and impact on biodiversity, though the effects are unpredictable.
- Technological development is expected to continue to enhance productivity. It may have negative effects on biodiversity by driving intensification and specialisation, while in other areas contributing to the development of more sustainable farming practices.
- Demographic change may exacerbate rural decline and abandonment in some marginal areas of the EU, whilst also offering a mix of positive and negative impacts in peri-urban areas where counter-urbanisation increases.

The combined effects on the agricultural sector of changes in these drivers, as well as developments in the CAP and other policies, have been modelled through EU studies examining future scenarios for agriculture and the rural economy, such as Scenar 2020 (Nowicki *et al,* 2009) and Eururalis (Rienks *et al,* 2008).

An analysis of future development trajectories for agriculture and the wider rural economy has been made by the Scenario 2020 study (Nowicki *et al,* 2009). Based on a combination of exogenous (socio-economic) and endogenous (policy) drivers this forecast the following changes in agriculture and the rural economy:

- A decline in the overall agricultural economy (although this is not expected to be significant even under more radical trade liberalisation scenarios, as a result of the buffering effect of land and labour costs)
- An increase in crop production, with increased yields due to technological change outstripping a forecast decline in the cultivated area
- An increase in production of energy crops
- Declining production of livestock, especially beef, which could fall by up to 35% under radical trade liberalisation scenarios
- Declining agricultural employment, especially in the less efficient agricultural economies of the new Member States, driving migration away from rural areas
- Declining agricultural land prices, in the case of radical CAP reform (-30%)
- Abandonment of marginal areas, especially as a result of declining areas devoted to crops and beef production, with the southern, eastern and northern countries of the EU most affected.
- Declining farm incomes, especially as a result of cuts in direct payments
- Effects of pillar 2 in increasing productivity (through support for farm investments) and diversification and supporting extensification (through agri-environment).
- A decline in the number of farm holdings by 25% in the EU15 and 40% in the EU12 by 2020.
- An increasing dichotomy in agricultural systems, with, on the one hand, a trend for specialisation (in open-field arable, horticultural and livestock-rearing/dairy systems) and on the other hand, a continuing role for extensive livestock-based systems with mixed cropping for fodder and fallow land.

Another scenario study, Eururalis (Rienks *et al,* 2008) predicted the following changes in agriculture and the rural economy to 2030:

- The future will be shaped by global economic and demographic forces, though policy can have an effect in mitigating adverse effects and encouraging positive opportunities
- Agriculture will continue to decline in its share of the rural economy and as a provider of employment
- Mechanisation will continue, helping to maintain production
- Agriculture will continue to account for almost 50% of land use in the EU
- Abandonment will be significant, at up to 10-12% of agricultural land under trade liberalisation scenarios
- Structural change will be greatest in the 12 newer Member States, helping to reduce disparities in productivity with the EU15, with adverse effects on farm employment

- 8% of agricultural land will be used for biofuel production, with adverse impacts on biodiversity
- Agricultural incomes will decline as a result of CAP reform
- Agricultural production will be maintained, but on a smaller land area
- There will be regional differences in future development, including continuing urbanisation in peri-urban regions and abandonment in natural regions
- Rural regions in the EU12 will lag behind urban ones, and behind those in the EU15, in economic development.

These trends are likely to have mixed implications for biodiversity, with negative effects caused by specialisation and abandonment, but also a trend towards extensification in some areas and positive incentives based on the increasing significance of Pillar 2 payments as a proportion of farm incomes.

Literature indicates a likely trend of putting more marginal land to intensive agricultural use in the new Member States (EEA, 2010b) and the current policy debates frequently invoke this trend as opportunity for food production and climate change mitigation. The extent of such changes across the EU-10 may be influenced by the availability of suitable marginal land as well as other policy incentives and exogenous drivers. The varying constraints upon the potential to intensify marginal land in different regions, related to the varying environmental, biophysical, agronomic, and climatic conditions, will play a role too. The trend would not always be recorded in official land use statistics, or captured through existing intensification parameters because it may involve more basic cropping changes (eg introduction of maize on uncropped marginal land) and possible pressures on biodiversity may go unnoticed. For example, the 2010 expert review of national renewable energy plans noted that the Romanian authorities declare 2 million of uncropped arable land in the South as possible to be mobilised for biomass production (Atanasiu, 2010) and target support under farm modernisation to these areas.

9.8 Annex 2.8: The status of Habitats of Community interest

Most natural and semi-natural habitats that are subject to agricultural use in the EU are habitats of Community interest (ie listed in Annex 1 of the Habitats Directive. Member States therefore have an obligation to maintain and restore them to Favourable Conservation Status (see Annex Box 1), in accordance with the aims of the Directive (through *inter alia* protection and management in Special Areas for Conservation). Article 17 of the Directive, also requires Member States to report on the condition of all habitats and species of Community interest. Therefore, to gain insights as to the condition of the habitats of Community interest that are associated with and dependent on agriculture and their prospects for the future, this study has examined the condition assessments carried out by Member States on these habitats (Annex Box 1). To assemble this information, we have utilised the data available from the European Topic Centre[48] and the Article 17 database[49]. We based our selection of habitats for analysis on the list developed for the European Topic Centre by Halada *et al* (2011). The analysis focuses on those habitats that are considered to be fully and or partly dependent on agricultural practices, and eliminated those where the agricultural relationship exists only in part of their area of distribution or under certain site conditions (see Annex 2.3, p248).

Annex Box 1: Summary of Member State reporting requirement on habitat conservation status

Under Article 17 of the Habitats Directive, Member States must report every six years on their progress in implementing the Directive and on the status of habitats and species of Community interest within their territories. Favourable conservation status can be described, in simple terms, as a situation where a habitat type or species is prospering (in both quality and extent/population) and with good prospects to do so in future. The definitions, under Article 1 of the Directive, take into account parameters including the '*extent of the area in which the habitat or species is found, the surface of the habitat area, its structure and functions (in case of habitat), the size of the population, its age structure, mortality and reproduction (of species)*' (EC, 2009d). A common assessment methodology was established in 2005, followed by supplementary guidance in 2006 (ETC/BD, 2006) to ensure a standardised reporting methodology. Nonetheless, differences in the way the data were collected and presented caused difficulties in presenting an overview at the EU level.

Analysis and reporting is in accordance with the following seven land and four marine 'bio-geographic regions', which form the strategic framework for the selection of sites and monitoring:

- Alpine (ALP)
- Atlantic (ATL)
- Boreal (BOR)
- Continental (CON)
- Macaronesia (MAC)
- Mediterranean (MED)
- Pannonian (PAN)

[48] http://bd.eionet.europa.eu/article17 http://bd.eionet.europa.eu/article17

[49] http://www.eea.europa.eu/data-and-maps/data/article-17-database-habitats-directive-92-43-eec/article-17-database-zipped-ms-access-format/article-17-database-zipped-ms-access-format
http://www.eea.europa.eu/data-and-maps/data/article-17-database-habitats-directive-92-43-eec/article-17-database-zipped-ms-access-format/article-17-database-zipped-ms-access-format

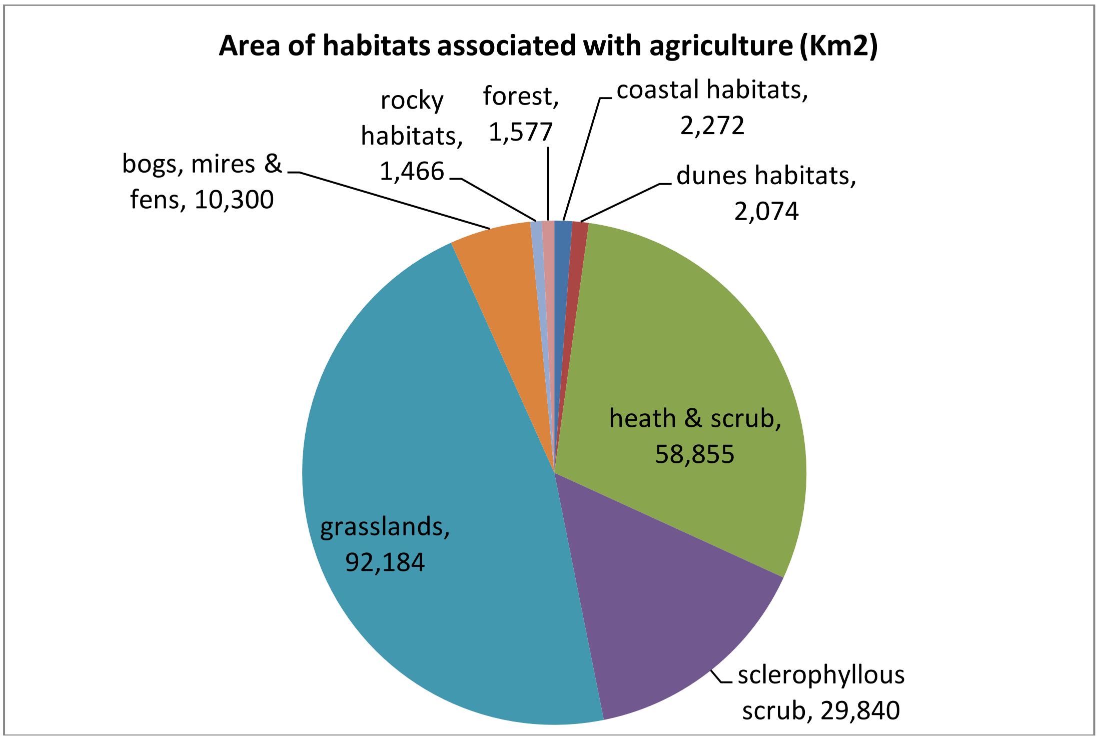
- Marine Atlantic (MATL)
- Marine Baltic (MBAL)
- Marine Macaronesia (MMAC)
- Marine Mediterranean (MMED)

The classification system for grading conservation status uses four main classes of conservation status: 'favourable' (FV), 'unfavourable-inadequate' (U1), 'unfavourable-bad' (U2) and 'unknown' (XX). If any of the four parameters was reported as 'unfavourable-inadequate' or 'unfavourable-bad' then the overall assessment was reported as either 'unfavourable-inadequate' or 'unfavourable-bad'. An additional class is used 'Unknown but not favourable' in circumstances for which it was not possible to distinguish between the two level classes of unfavourable.

9.8.1 *Comparison across habitat groups*

Agricultural habitats within Natura 2000 are dominated by three groups (grasslands, heath and scrub, and sclerophyllous scrub) which constitute 91 per cent of the total area (see Annex Figure 4). Almost one half of the area of these sites are classified under 'grasslands'.

Annex Figure 4: Area of agricultural habitat groups as a proportion of the total area

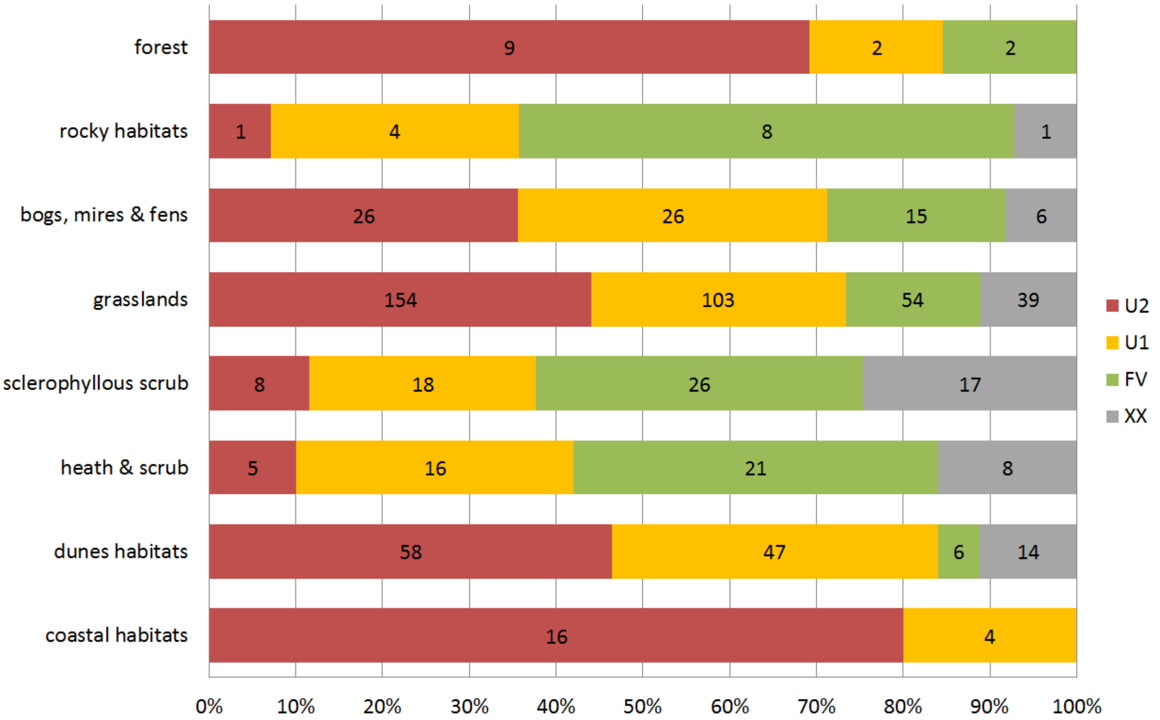


Source: http://bd.eionet.europa.eu/article17/index_html/habitatsreport

The overall conservation status of each habitat group across the EU-25 can be expressed by presenting the number of assessments that fall into each of the conservation status classifications, as indicated in Annex Figure 5. This reveals that coastal habitats and forests have the highest proportion (80 and 70 per cent) in Unfavourable-bad condition respectively. However, the status of bogs, mires and fens, grasslands and dunes is also of considerably concern, especially when one takes into account the proportion of habitats that have an unfavourable-inadequate status, as well as unfavourable-bad.

This analysis, which has exclusively considered the conservation status of agricultural habitats therefore reaffirms the broader findings in the Biodiversity Baseline report (EEA, 2010a) that a particularly low proportion of agricultural habitats have a favourable conservation status. It is therefore clear that the aims of the Habitats Directive will not be met unless the condition of such habitats is improved.

Annex Figure 5: Conservation status of habitats associated with agriculture (no of sites)



Source: Own data based on ETC/BD data: http://bd.eionet.europa.eu/article17/index_html/habitatsreport

9.8.2 Comparison across biogeographic regions

Significant differences exist in the conservation status of agricultural habitats across the biogeographic regions Annex Figure 6). The Pannonian and Atlantic regions report very few sites in favourable condition (2 and 6 per cent respectively) compared with a relatively high proportion in the Mediterranean and Alpine regions (36 and 33 per cent respectively). In the Atlantic region, this may reflect greater intensification of agriculture, although this is less likely to be the case in the Pannonian region where abandonment of agricultural management may be more likely to be the cause. It should also be borne in mind that there may be differences in approach to the application of the criteria for assessing conservation status, particularly in Italy and Greece [ETC/BD, 2008[50]]. The Mediterranean in particular, has a very high proportion of habitats of unknown status making comparisons with other regions more difficult.

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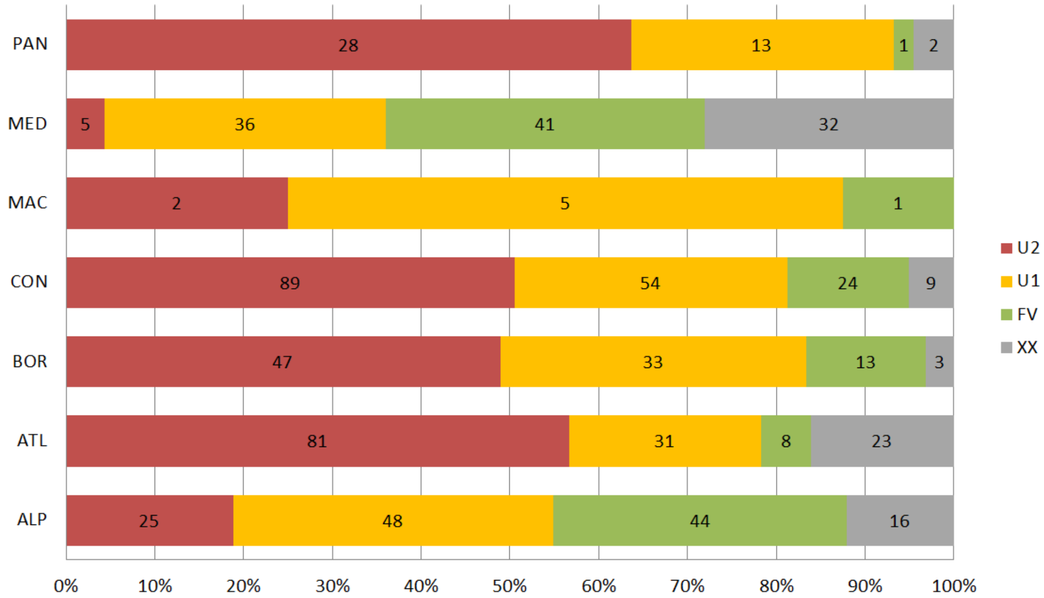
[50] http://eea.eionet.europa.eu/Public/irc/eionet-circle/habitats-art17report/library?l=/papers_technical/specific_analysispdf/_EN_1.0_&a=d http://eea.eionet.europa.eu/Public/irc/eionet-circle/habitats-art17report/library?l=/papers_technical/specific_analysispdf/_EN_1.0_&a=d

Annex Figure 6: Conservation status of habitats associated with agriculture in the biogeographic regions

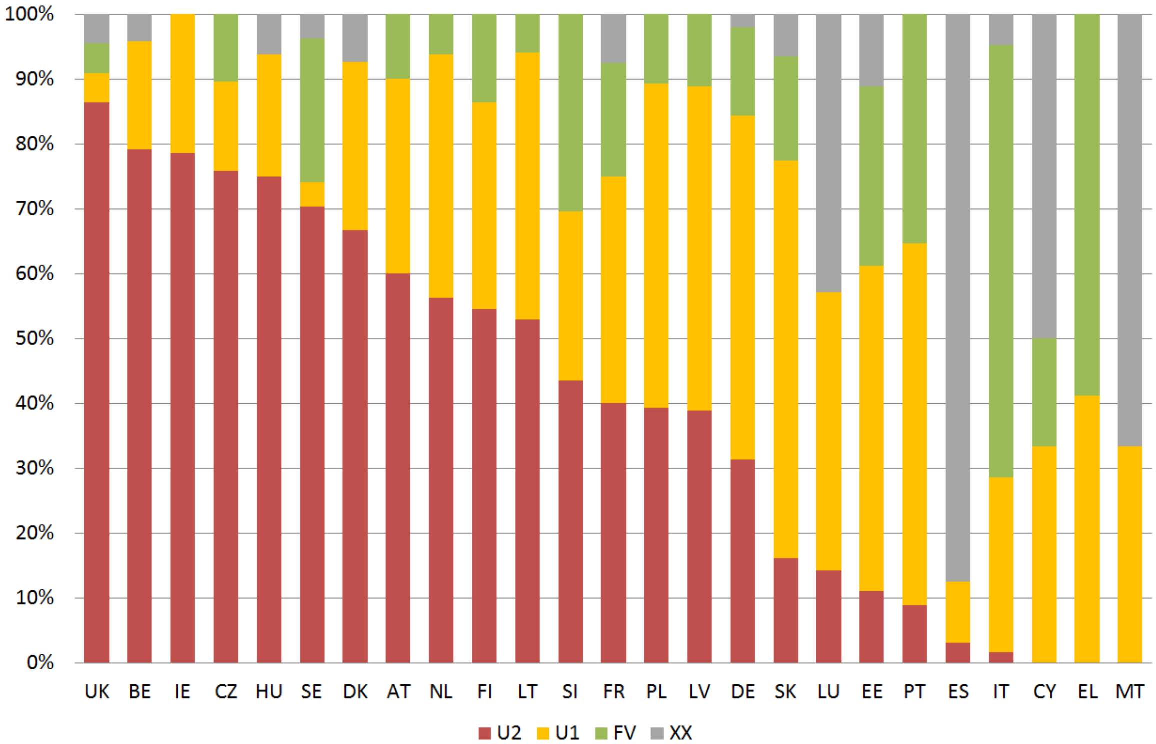


Source: Own data based on ETC/BD data http://bd.eionet.europa.eu/article17/index_html/habitatsreport

9.8.3 Conservation status in Member States

Annex Figure 7 indicates that agricultural habitats in western Europe appear to be in worse condition than those in central and eastern Europe, probably largely due to greater intensification, specialisation and concentration of farming processes. However, some central European countries also show high proportions of habitats being in unfavourable condition, probably as a result of intensification in some areas, and abandonment in others.

Annex Figure 7: Conservation status of habitats associated with agriculture across Member States (%)



Source: Own data based on ETC/BD data http://bd.eionet.europa.eu/article17/index_html/habitatsreport

9.9 Annex 2.9: Quantification of risks and impacts of land-use change on species and the potential impacts of mitigation measures

9.9.1 The trait-based modelling methodology and UK results

Risk-assessment frameworks based on assessments of the ecological traits of species have been developed and used to quantify the impacts of recent agricultural changes on agricultural species, and to predict the impacts of potential agricultural changes. These trait based assessments have been developed by Simon Butler and colleagues at Reading University (UK) initially on UK farmland birds (Butler *et al,* 2007a). In this approach, the risk of agricultural change x to species y, is defined as the degree of coincidence between the environmental impacts of that change and the resource requirements of that species, adjusted for the species' ecological resilience, which is defined by the breadth of its resource requirements and its reliance on farmland for those resources.

Risk quantification

Risk from agricultural changes were quantified according to the following steps:

1. Characterisation of each species ecological requirements

Empirical evidence from studies of farmland birds indicates that agricultural changes are most likely to have significant impacts if they affect food abundance (as a result of a change in foraging habitat availability and/or a change in prey abundance in the existing foraging habitat) and nesting success (as a result of changes in nesting habitat availability and/or a reduction in nest success in the existing nesting habitat). The ecological requirements of 62 species that are associated with farmland habitats in the UK were categorised by 14 experts according to the following components:

a. Diet – summer and winter: below ground invertebrates, above ground invertebrates, plant material, weed seeds, vertebrates.
b. Foraging habitat – summer and winter: cropped area, margin, hedgerow.
c. Nesting habitat: cropped area, margin, hedgerow.

The importance of each component was scored according to a simple binary response of important or not important.

2. Assessment of the exposure to risk from agricultural changes

Exposure to risk from changes in agricultural practices were assessed by identifying all points of coincidence between the potential environmental impact of agricultural change x and the ecological requirements of species y (in terms of the components assessed in step 1). Potential environmental impact was defined as the possible reduction in the quantity or quality of one of these components as a consequence of the agricultural change. The assessment of exposure to risks in the 2007 UK study considered six key components of agricultural intensification: the switch from spring to autumn sowing, increased agrochemical inputs, loss of non-cropped habitats, land drainage, the switch from hay to silage and the increased intensity of grassland management. Drawing on available scientific evidence, each was assessed with respect to their impact on food abundance, foraging habitat availability, nesting habitat availability and nesting success. For example, for some species a change from spring to autumn sowing is considered to result in a loss of crop foraging habitat in summer and winter (due to the height and density of the crop), seed food resources in the crop in winter (due to the loss of over-winter stubbles) and loss of in-crop nest sites (due to the crop's height and density). The impacts of each change on each habitat and food resource component were simply assessed as significantly negative or not (none were significantly positive), see Annex Box 2 for a worked example.

The combined diet- and nest-related risks were scored using a simple formula that gave an equal weighting for all sources of risk and assumed that impacts are additive across risk sources. The scores take into account the estimated coincidence between potential impacts on a species' diet and foraging and nesting habitat and the number of diet and foraging and nesting habitat options that the species has. Thus the larger the proportion of food resources, feeding habitats and nesting habitats that are impacted the greater the perceived risk to a species.

3. Determining the level of effect of risk exposure by adjusting for the ecological resilience of species y.

Lastly, the combined assessment of agricultural risks on each species was adjusted according the species reliance on farmland habitat, so that it would better reflect the likely impact on the species' population as a whole (ie across all habitats). To do this, the farmland risk score was divided by a farmland reliance score, where species that have a major reliance on farmland habitats scored 1, those with a moderate reliance scored 2 and those with a minor reliance scored 3.

With respect to the example in Annex Box 2, the Corn Bunting is highly restricted to farmland in the UK, and therefore its farmland risk score remains at 12.5, which is the highest of all the 62 species that were included in the analysis.

Annex Box 2: Worked example calculation of the combined risk score for six agricultural changes for the Corn Bunting (*Milaria calandra*)

Ecological requirements

The number of components used is indicated in the parentheses, and indicate the values used in the risk score formula, set out below

Category	Season	Components used
Diet	Summer	Above ground invertebrates, seeds (Ds=2)
	Winter	Seeds (Dw=1)
Foraging habitat	Summer	Cropped area (Fs=1)
	Winter	Cropped area (Fw=1)
Nesting habitat		Cropped area (N=1)
Reliance on farmland		Major (score 1)

Calculation of farmland risk score

Based on the number of points of coincidence between potential impacts of six agricultural changes and ecological requirements according to the following formula: Risk score = $(As/(Ds *Fs) + Aw/(Dw *Fw) + Bs/Fs + Bw/Fw + C1/N + C2/N)$.

As = number of points of coincidence between potential impact on and the species' use of diet components in summer. Aw = as for As but for winter. Bs = number of points of coincidence between potential impact on and the species' use of foraging habitat components in summer. Bw = as for Bs but for winter. Ds = number of diet components used by the species in summer. C1 and C2 = number of points of coincidence between potential impact on and the species' use of nesting habitat components if impact is through reduced success in existing habitat and loss of habitat respectively and N = number of nesting habitat components used by the species.

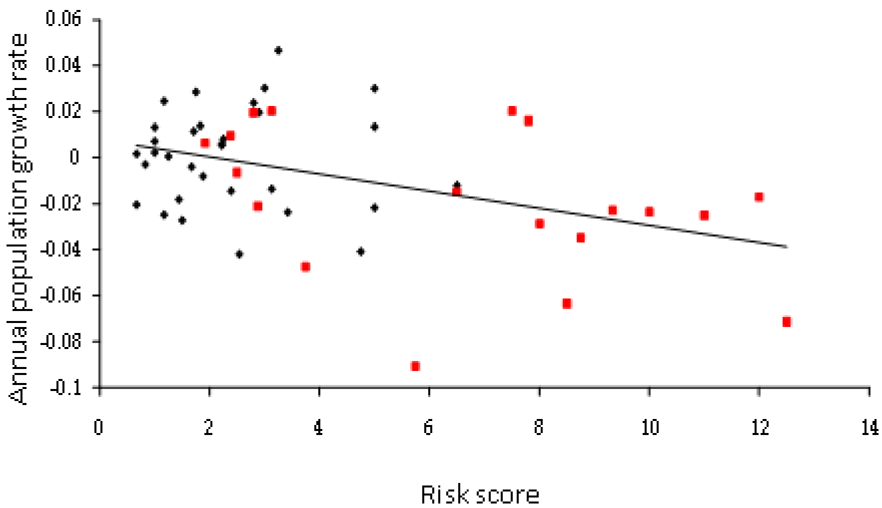
Agricultural change	As	Aw	Bs	Bw	C1	C2	Risk score1
Spring to autumn sowing		1	1	1		1	4
Increased agrochemical inputs	2	1					2
Loss of non-cropped habitat							0
Land drainage	1						0.5
Switch from hay to silage			1		1		2
Intensified grassland management	2	1			1	1	4
Total risk							**12.5**

Validation and quantification of relationship between risk and population trends
Following the completion of the risk assessment, General Linear Modelling (GLM) was used to investigate the relationship between the estimated risk scores and observed population growth rates (*pgr*), which were calculated using population monitoring data available from the British Trust for Ornithology. The modelling also tested the validity of giving an equal weighting to each source of risk in terms of its relationship to conservation status and population growth, and the assumption that different risk sources have an additive effect. The analysis suggested that the assumptions were reasonable. The most parsimonious models of conservation status and *pgr* only included total risk score. In other words, adding additional factors into the model did not result in significant improvements in the fit between observations and model predictions). ..

The results of the analysis indicated that species with high risk assessments scores were significantly more likely to have a negative *pgr* (ie be declining) as indicated in Annex Figure 8. Furthermore, the risk score was significantly related to the probability that a species would be considered to be threatened in the UK.

Annex Figure 8: Risk assessment scores and population growth rates between 190 and 2001 in UK farmland birds

Source: adapted from Butler *et al* (2007a) Red squares indicate species that contribute to the UK farmland bird indicator



Use of the model for predicting the impacts of mitigation measures for risks
The UK model and bird risk framework has also been used to assess the potential land use changes (eg the use of genetically modified herbicide-resistant crops) and the benefits of mitigation measures for agricultural impacts on birds, as implemented through the England Entry Level Stewardship (ELS) agri-environment scheme. To examine the benefits of ELS, they firstly assessed whether the scheme was targeting the mains causes of declines in

farmland birds in agricultural habitats. Using the scores from the validation process for all 62 assessed species they calculated a summed total landscape score. This was then broken down to calculate the proportion of total risk arising from changes to food abundance, either through the loss of foraging habitat or the loss of prey items in existing habitat, and nesting success, either through the loss of nesting habitat or reduced success in existing habitat, in cropped areas, margins and hedgerows. The results in Annex Table 3 clearly show that, for the combined species risks, by far the largest proportion of risk is associated with the loss of in crop food resources. Risks associated with nesting within crops and the loss of food resources within crop margins were also significant. Risks associated with nesting in crop margins and feeding and nesting in hedgerows were very low.

Although risks to individual species of course will vary considerably, these results indicate that farmland bird conservation polices and practical agri-environment measures should reflect these risks, by ensuring actions primarily address food resources in the cropped area (for example by reducing the use of herbicides and pesticides on crops, providing fallow fields or patches, maintaining stubbles over-winter, allowing crops to set-seed or planting areas with seed-bearing plants). In contrast, the study found from ELS uptake data that the majority of ELS actions affected hedges and margins, and food resources within these (Annex Table 3). The ELS scheme does in fact include a wide variety of options that have the potential to address all the main risk factors. It therefore appears that the mismatch between conservation priorities and actions is the result of inadequate uptake of appropriate ELS options.

Annex Table 3: Comparison of the relative distribution of the causes of farmland bird population decline and the uptake of mitigation measures between components of ecological requirement

Ecological requirement components	Proportion of total risk score	Proportion of mitigation points allocated
Crop food resources	**0.54**	**0.16**
Crop nesting	**0.16**	**0.07**
Margin food resources	0.13	0.22
Margin nesting	0.05	0.09
Hedgerow food resources	0.05	0.36
Hedgerow Nesting	0.07	0.09

Source: Adapted from Butler *et al* (2007a) supporting on line material

Mitigation points reflect the proportional uptake of options in the England Entry Level Stewardship Scheme, and the estimated potential for each option to mitigate risks associated with each ecological requirement component. Components of ecological requirements are highlighted in bold if the proportion of total risk score is greater than the proportion of mitigation points.

The trait-based risk assessment approach was subsequently used to assess the risks from key agricultural changes on bumblebees, butterflies, mammals and arable plants in farmland habitats (Butler *et al,* 2009). The results from this were then used, together with those from the farmland bird assessments, to derive a standardised cross-taxonomic index quantifying biodiversity health in agricultural systems generally. The index centred on a point of sustainability defined as the maximum level of risk in the agricultural landscape at which national populations are predicted to remain stable. The results suggested that the populations of two-thirds of the 333 plant and animal species assessed were unsustainable under current UK agricultural practices. Furthermore, the framework was used to assess the potential benefits of ELS across the taxa groups. This showed that the potential for the ELS scheme to mitigate impacts on biodiversity was not being realised, due to insufficient uptake of options that address risks in the cropped area, reaffirming the conclusions from the 2007 studies on birds.

9.9.2 European model and results

The approach used in the UK study by Butler *et al* (2007a) was further developed and expanded by Butler *et al* (2010) to measure the impacts of agricultural changes in the EU on common farmland birds and to quantify the likely impacts of further EU-scale changes in agricultural practices. The study generated risk scores for 54 species, including all those that contribute to the European Farmland Bird Index (EFBI). Risk scores were calculated firstly for each of the 20 countries that contribute data to EFBI[51]. A pan-European risk score was then calculated for each species as the average of its total risk scores in each constituent country, weighted by the relative breeding populations in each country (Birdlife International, 2004). Due to the scale of the analysis, the risk score calculations took into account the migration patterns of the species involved (because these affect their exposure to agricultural changes).

The risk assessments covered the six agricultural changes included in the 2007 UK study, together with the potential risks from loss of semi-natural grassland and afforestation. It is therefore important to note that it is not a comprehensive assessment of all changes in agricultural practices that may have detrimental or beneficial biodiversity impacts. Nevertheless, the issues considered include those that appear to be most significant at an EU scale from available evidence (for example Billeter *et al,* 2008; Stoate *et al,* 2001; Stoate *et al,* 2009). Therefore the study provides an assessment of the likely impacts of key land use changes and agricultural practices across Europe as whole, rather than at regional or nationals scales where some pressures may vary from the EU average.

The study by Butler *et al* (2010) showed that changes in food resource availability, and to a lesser extent suitable nesting sites, within the cropped area of agricultural landscapes is the main cause of declines in EU populations of most common farmland bird species. As in the 2007 UK study, there was a significant negative relationship between estimated risk scores for species and their observed *pgr*, such that most species with a risk score greater than 5 are experiencing population declines. The results also reaffirmed the distribution of risks found in the UK study. More than 76% of the total risk accrued by the 54 farmland birds was associated with detrimental changes that occurred in the cropped area of landscapes, with three-quarters of this linked to reductions in the quantity or quality of food resources, and one quarter with reduced nesting success.

The 2010 European study also used the model and risk framework to estimate the potential impacts of four landuse and policy scenarios on the EFBI in 2020. Scenario 1 was a baseline scenario under which rates of intensification and abandonment at the time persist to 2020,

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[51] Finland, Norway, Sweden, Denmark, Germany, Holland, Belgium, UK, Ireland, Switzerland, Austria, Estonia, Latvia, Poland, Hungary, Czech Republic, Italy, France, Spain and Portugal

but with the continuation of the old set-aside policy. The remaining three scenarios introduced further risks to birds in addition to those considered in Scenario 1. Scenario 2 examined the loss of compulsory set-aside (which subsequently occurred) and indicated that 43 of the species included in these analyses, including 28 of the 33 EFBI species, would be expected to experience a reduced *pgr* such that the predicted EFBI in 2020 would be 8% lower than under the baseline Scenario 1. Scenario 3 examined accelerated agricultural intensification in east Europe, which predicted a large detrimental impact on the EFBI, with 2020 levels expected to be between 20% and 25% lower than baseline Scenario 1. Scenario 4 investigated the impacts of a reduction of 5%, 10% and 15% of UAA, the results of which suggest that each 5% decline in the UAA would lead to a 2–2.5% reduction in the EFBI by 2020 compared to the baseline scenario.

Finally the study examined the contribution that each Member State's farmland bird populations make to the EFBI and the relationship between this and Axis 2 funding under Pillar 2 of the CAP. The results showed that agricultural changes in each Member State do not have an equal impact on the EFBI, with land-use and management change in Spain having a particularly large influence on its level, and that funding is poorly targeted with respect to the conservation needs of farmland birds.

9.9.3 Commissioned analysis for this CAP and biodiversity study

Although the EU-wide model by Butler *et al* only addresses birds and has other limitations, it is a particularly useful and sensitive analytical tool for objectively quantifying current threats and investigating the potential impacts of future land use change on farmland bird populations. Impacts on birds will also to some extent indicate likely impacts on other biodiversity components. As part of this CAP and Biodiversity study, we have therefore taken this approach and analysis further, through collaboration with Simon Butler and colleagues at the University of Reading, by using the 2010 study data and equations to assess the potential impacts of agricultural biodiversity conservation measures on farmland birds. Specifically, we assess how a range of potential conservation measures, which would address some of the main risk to farmland birds (and in so doing benefit some other species) would offset existing risk in the landscape and predict the *pgr* for each EFBI species accordingly.

For this analysis we used the Butler *et al* (2010) risk scores from 33[52] of the 36 EFBI species as presented in Annex Table 4. The total risk score (using the same formula as in Annex Box 2) for each species used in the analyses are disaggregated in the table according to both where (cropped area, margin or hedgerows) and how (loss of nesting, summer foraging or winter foraging resources) the risk has been generated. The percentages show the relative impacts of each factor on each species, and the totals indicate the magnitude of the combined impacts within each species (eg the species at greatest risk is *Melanocorypha calandra*) and the greatest source of risk across all species is from the loss of summer foraging habitat.

[52] Stone Curlew (*Burhinus oedicnemus*), Black-headed Bunting (*Emberiza melanocephala*) and Lesser Grey Shrike (*Lanius minor*) were excluded as the time series data were inadequate to provide reliable trend estimates.

Annex Table 4: Percentage distribution of risk scores across landscape components and seasonal ecological requirements and total risk scores for 33 EFBI specie

	Percentage score									Total score
	Cropped area			**Margin**			**Hedgerow**			
	Nest	**Summer foraging**	**Winter foraging**	**Nest**	**Summer foraging**	**Winter foraging**	**Nest**	**Summer foraging**	**Winter foraging**	
Alauda arvensis	31.7	31.7	36.6	0.0	0.0	0.0	0.0	0.0	0.0	**7.8**
Anthus campestris	45.3	54.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.6**
Anthus pratensis	23.3	28.2	48.4	0.0	0.0	0.0	0.0	0.0	0.0	**5.7**
Calandrella brachydactyla	48.2	51.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**6.7**
Carduelis cannabina	15.6	23.2	41.6	6.5	9.8	0.0	3.3	0.0	0.0	**5.4**
Ciconia ciconia	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**1.3**
Corvus frugilegus	0.0	48.2	41.2	0.0	0.0	0.0	10.5	0.0	0.0	**7.6**
Emberiza cirlus	17.7	39.3	35.4	7.7	0.0	0.0	0.0	0.0	0.0	**9.1**
Emberiza citrinella	0.0	42.1	47.6	6.9	0.0	0.0	3.5	0.0	0.0	**4.9**
Emberiza hortulana	63.1	22.9	0.0	0.0	8.9	0.0	0.0	5.0	0.0	**1.8**
Falco tinnunculus	0.0	25.7	19.0	0.0	20.7	20.9	13.7	0.0	0.0	**4.7**
Galerida cristata	19.6	39.2	33.0	8.2	0.0	0.0	0.0	0.0	0.0	**7.0**
Galerida theklae	22.2	24.3	22.2	9.7	11.9	9.7	0.0	0.0	0.0	**3.7**
Hirundo rustica	0.0	55.1	0.0	0.0	26.9	0.0	0.0	17.9	0.0	**1.6**
Lanius collurio	0.0	0.0	0.0	26.5	40.4	0.0	13.2	19.9	0.0	**1.4**
Lanius senator	0.0	0.0	0.0	0.0	46.4	0.0	30.6	23.0	0.0	**2.2**
Limosa limosa	47.6	52.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**8.4**
Melanocorypha calandra	33.3	40.6	26.1	0.0	0.0	0.0	0.0	0.0	0.0	**9.7**
Miliaria calandra	31.6	34.9	33.5	0.0	0.0	0.0	0.0	0.0	0.0	**9.6**
Motacilla flava	54.3	31.8	0.0	0.0	13.9	0.0	0.0	0.0	0.0	**2.4**
Oenanthe hispanica	30.1	36.8	0.0	13.2	19.9	0.0	0.0	0.0	0.0	**2.7**
Passer montanus	0.0	0.0	38.8	0.0	19.0	15.3	15.3	11.6	0.0	**2.9**
Perdix perdix	16.2	24.3	39.5	6.1	10.8	0.0	3.1	0.0	0.0	**4.9**
Petronia petronia	0.0	34.5	24.5	0.0	16.9	10.3	13.8	0.0	0.0	**2.6**
Saxicola rubetra	0.0	0.0	0.0	44.9	55.1	0.0	0.0	0.0	0.0	**0.7**
Saxicola torquata	0.0	0.0	0.0	26.1	39.0	34.9	0.0	0.0	0.0	**3.7**
Serinus serinus	0.0	24.7	23.7	0.0	11.6	10.0	17.9	5.8	6.3	**1.9**
Streptopelia turtur	0.0	52.2	0.0	23.9	0.0	0.0	11.9	11.9	0.0	**1.3**
Sturnus unicolor	0.0	51.4	38.7	0.0	0.0	0.0	9.9	0.0	0.0	**3.6**
Sturnus vulgaris	0.0	45.9	45.7	0.0	0.0	0.0	8.4	0.0	0.0	**4.6**
Sylvia communis	0.0	0.0	0.0	40.0	60.0	0.0	0.0	0.0	0.0	**1.7**
Upupa epops	0.0	51.0	0.0	0.0	29.5	0.0	19.5	0.0	0.0	**2.0**
Vanellus vanellus	30.1	33.2	36.7	0.0	0.0	0.0	0.0	0.0	0.0	**9.4**
			37.45	**5.64**	**10.21**	**3.56**	**5.26**	**1.76**	**0.12**	**146.9**

The 2007 and 2010 studies by Butler *et al* and evidence examined in the literature review shows that most of the impacts of agricultural change on farmland species relate to in-field changes rather than those affecting field boundaries. There is also some uncertainty over the amount of land that needs to be managed in a beneficial way to halt and reverse farmland bird declines and meet related biodiversity policy objectives. Taking these issues into account, we used a set of scenarios that allow us to explore the following three key questions relating to the design of practical farmland bird conservation measures:

- *How much*?, by comparing the potential benefits of 5% and 10% land allocation to conservation management measures.
- *Where*?, by comparing the benefits of delivering beneficial management to the cropped area, margin and hedgerow compartments of the agricultural landscape.
- *What*?, by exploring the relative merits of a range of types of management action types that deliver different resources.

Risk offset calculation

The risk offset calculations are based on the assumption that a 5% or 10% land allocation to practical conservation measures has the potential to offset 5% or 10% of the total risk score respectively. Although simplistic, this 1:1 land to risk offset assumption reflects empirical evidence and the results of the model validation (described above) that risks tend to be additive and in proportion to the land affected. Some measures (such as Skylark scrapes and the planting of seedmixes) can potentially fully offset risks using small amounts of land (Winspear *et al,* 2010). However, such measures are not widely used across the EU and are generally only applied in arable systems because measures to increase food resources in grasslands are still under development (Peach, 2011; Westbury, 2011). Most mitigation measures therefore tend to be general like-for-like habitat maintenance or restoration measures that can be expected to provide benefits in proportion to their area. Furthermore, the benefits of some efficient measures may be counterbalanced by occasional inefficiencies in others, since not all measures will deliver their potential, for example because they are inappropriately located or implemented. Given these complexities and the absence of consistent EU wide data on the impacts of conservation measures, the assumption that risks are offset in proportion to land allocation seems reasonable. Nevertheless, some care should be taken in drawing conclusions on the predicted amount of land needed to halt population declines. However, the relative benefits of placing measures in hedges, margins and crops is not significantly affected by the assumed 1:1 proportional risk offset, so conclusions on these issues should be more robust.

Given that the sum of risk across the 33 EFBI species is 194.5, we have therefore assumed that a 5% land allocation therefore has the potential to offset 9.73 risk points whilst a 10% land allocation has the potential to offset 19.5 risk points. Our analyses below are based on the distribution of management actions to offset this level of risk in various locations. Furthermore, different species rely on different resource types. Thus both the species-specific and overall benefits of the same level of risk offset will vary according to where management actions occur and the types of resources delivered. For example, species found only in the cropped area will not benefit from beneficial hedgerow management and *vice versa* whilst a species for which the detrimental impacts of land-use change are predominately manifest through the loss of nest site resources will benefit to a much lesser extent from beneficial management designed to deliver winter food resources than management delivering nest site resources. For each scenario, we discounted species' risk scores according to the management delivered:

- *Scenario 1: Current conditions persist*
    - No risk mitigation, current levels of risk persist

- *Scenario 2: 5% land allocated, management all in cropped area*
  - 9.73 risk points mitigated in cropped area. This represents 6.6% of total cropped area risk. Each species' cropped area risk was therefore reduced to 93.4% current levels whilst margin and hedge levels were held at 100% current levels.

- *Scenario 3: 5% land allocated, management all in margin*
  - 9.73 risk points mitigated in margins. This represents 31.4% of total margin risk. Each species' margin area risk was therefore reduced to 68.6% current levels whilst cropped area and hedge levels were held at 100% current levels.

- *Scenario 4: 5% land allocated, management all in hedgerow*
  - 9.73 risk points mitigated in hedgerows. This represents 64.9% of total hedgerow risk. Each species' hedgerow risk was therefore reduced to 35.1% current levels whilst copped area and margin levels were held at 100% current levels.

- *Scenario 5: 10% land allocated, management all in cropped area*
  - 19.5 risk points mitigated in cropped area. This represents 13.1% of total cropped area risk. Each species' cropped area risk was therefore reduced to 86.9% current levels whilst margin and hedge levels were held at 100% current levels.

- *Scenario 6: 10% land allocated, management all in margin*
  - 19.5 risk points mitigated in margins. This represents 62.7% of total margin risk. Each species' margin area risk was therefore reduced to 37.3% current levels whilst cropped area and hedge levels were held at 100% current levels.

- *Scenario 7: 10% land allocated, management all in hedgerow*
  - 19.5 risk points mitigated in hedgerows. This represents 129.5% of total hedgerow risk. Each species' hedgerow risk was therefore reduced to 0 whilst copped area and margin levels were held at 100% current levels.

- *Scenario 8: 5% land allocated, management split between cropped area, margin & hedgerow*
  - 3.25 risk points mitigated in each of cropped area, margin and hedgerows. This represents 2.2%, 10.5% and 21.6% of total cropped area, margin and hedgerow risk respectively. Each species' cropped area risk was therefore reduced to 97.8% current levels, margin risk to 89.5% current levels and hedgerow risk to 78.4% current levels.

- *Scenario 9: 10% land allocated, management split between cropped area, margin & hedgerow*
  - 6.5 risk points mitigated in each of cropped area, margin and hedgerows. This represents 4.4%, 20.9% and 43.2% of total cropped area, margin and hedgerow risk respectively. Each species' cropped area risk was therefore

reduced to 95.6% current levels, margin risk to 79.1% current levels and hedgerow risk to 56.8% current levels.

The scenarios above assume that the management delivered provides nesting, summer food and winter food resources in broadly equivalent proportions to that at which they have been lost from the landscape. However, as with allocation of management effort between cropped area, margin or hedgerows, varying the types of resources delivered by the same level of management is likely to alter the extent of any benefit. To demonstrate this, we focus on management options for the cropped area and assess the relative merits of delivering different resource types.

- *Scenario 10: 5% land assigned, management provides crop nest resource only*
  9.73 risk points mitigated in cropped area, with management providing only nesting resources. This represents 27.9% of cropped area risk associated with loss of nesting resources. Each species' cropped area nest risk was therefore reduced to 72.1% current levels whilst remaining crop risk and all margin and hedge risk were held at 100% current levels.

- *Scenario 11: 10% land assigned, management provides crop nest resource only*
  19.5 risk points mitigated in cropped area, with management providing only nesting resources. This represents 55.9% of cropped area risk associated with loss of nesting resources. Each species' cropped area nest risk was therefore reduced to 44.1% current levels whilst remaining crop risk and all margin and hedge risk were held at 100% current levels.

- *Scenario 12: 5% land assigned, management provides crop summer food resources only*
  9.73 risk points mitigated in cropped area, with management providing only summer food resources. This represents 14.7% of cropped area risk associated with loss of summer food resources. Each species' cropped area summer food risk was therefore reduced to 85.3% current levels whilst remaining crop risk and all margin and hedge risk were held at 100% current levels.

- *Scenario 13: 10% land assigned, management provides crop summer food resources only*
  19.5 risk points mitigated in cropped area, with management providing only summer food resources. This represents 29.4% of cropped area risk associated with loss of summer food resources. Each species' cropped area summer food risk was therefore reduced to 70.6% current levels whilst remaining crop risk and all margin and hedge risk were held at 100% current levels.

- *Scenario 14: 5% land assigned, management provides crop winter food resources only*
  9.73 risk points mitigated in cropped area, with management providing only winter food resources. This represents 20.6% of cropped area risk associated with loss of winter food resources. Each species' cropped area winter food risk was therefore

reduced to 79.4% current levels whilst remaining crop risk and all margin and hedge risk were held at 100% current levels.

- *Scenario 15: 10% land assigned, management provides crop winter food resources only*
  19.5 risk points mitigated in cropped area, with management providing only winter food resources. This represents 41.2% of cropped area risk associated with loss of winter food resources. Each species' cropped area winter food risk was therefore reduced to 59.8% current levels whilst remaining crop risk and all margin and hedge risk were held at 100% current levels.

- *Scenario 16: 5% land assigned, management provides full range of resource types*
  Summer food, winter food and nest resources provided by management in cropped area. Thus 9.73 risk points from each source mitigated. This represents 27.9 cropped area nest risk, 14.7% summer food risk and 20.6% winter food risk. Each species cropped area nest, summer food and winter food risk were therefore reduced to 72.1%, 85.3% and 79.4% current levels respectively whilst margin and hedgerow risk were held at 100% current levels.

- *Scenario 17: 10% land assigned, management provides full range of resource types*
  Summer food, winter food and nest resources provided by management in cropped area. Thus 19.5 risk points from each source mitigated. This represents 55.9 cropped area nest risk, 29.4% summer food risk and 41.2% winter food risk. Each species cropped area nest, summer food and winter food risk were therefore reduced to 44.1%, 70.6% and 59.8% current levels respectively whilst margin and hedgerow risk were held at 100% current levels.

Results

The predicted *pgr* of each species under Scenarios 1-9 are presented in Annex Table 5 and under Scenarios 10-17 are presented in Annex Table 6. As would be expected, increasing the area of land allocated to specific management measures provides greater benefit, as demonstrated by the less negative *pgr* for each species under the 10% scenarios compared to the 5% scenarios. The results demonstrated that if only 5% of land is allocated, directing all the management action to delivering resources back into the cropped area is likely to be most beneficial for 16 species. For 7 species, the greatest improvement in *pgr* is expected to be delivered by targeting management to the margins whilst 10 species would benefit most from hedgerow-specific management. If 10% of land is allocated, the benefits of focussing management to the cropped area increase, with 18 species benefiting most. Under this level of land allocation 9 species benefit most if efforts are focussed only on margin management and only 6 if efforts are focussed only on hedgerow management.

On a species level, distributing management effort evenly between the three main landscape components reduced the overall benefit, whereas focussing effort on one specific component was always more beneficial. However, because the most beneficial component varied between species, splitting management effort evenly between components had a greater overall benefit, in terms of the number of species, than either margin- or hedgerow-focussed effort. Cropped area-focussed management is expected to have greater benefits for more species than evenly distributed effort, and the species affected are of higher conservation concern. This conclusion accords with the results of the trait-based modelling in the UK on both birds and other taxa (such as were bumblebees, butterflies, mammals and broad-leaved plants), and is therefore likely to be representative of the benefits of cropped areas for biodiversity in general.

Annex Table 5: Predicted annual population growth rates for 33 EFBI species in response to risk mitigation through specific land management options

Each *pgr* is the expected annual change in population size, eg under Scenario 1 the population of *Alauda arvensis* would decline by 4.26% per year. See text for details of scenarios.

	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Scenario 7	Scenario 8	Scenario 9
Alauda arvensis	-0.0426	-0.0396	-0.0426	-0.0426	-0.0365	-0.0426	-0.0426	-0.0416	-0.0406
Anthus campestris	-0.0149	-0.0137	-0.0149	-0.0149	-0.0126	-0.0149	-0.0149	-0.0145	-0.0141
Anthus pratensis	-0.0255	-0.0236	-0.0255	-0.0255	-0.0218	-0.0255	-0.0255	-0.0249	-0.0242
Calandrella brachydactyla	-0.0306	-0.0284	-0.0306	-0.0306	-0.0262	-0.0306	-0.0306	-0.0299	-0.0291
Carduelis cannabina	-0.0240	-0.0225	-0.0226	-0.0234	-0.0211	-0.0212	-0.0231	-0.0228	-0.0217
Ciconia ciconia	-0.0047	-0.0043	-0.0047	-0.0047	-0.0038	-0.0047	-0.0047	-0.0046	-0.0044
Corvus frugilegus	-0.0395	-0.0368	-0.0395	-0.0364	-0.0342	-0.0395	-0.0347	-0.0376	-0.0357
Emberiza cirlus	-0.0426	-0.0399	-0.0415	-0.0426	-0.0371	-0.0404	-0.0426	-0.0413	-0.0400
Emberiza citrinella	-0.0216	-0.0201	-0.0210	-0.0210	-0.0187	-0.0205	-0.0207	-0.0207	-0.0199
Emberiza hortulana	-0.0050	-0.0045	-0.0047	-0.0047	-0.0040	-0.0045	-0.0045	-0.0046	-0.0043
Falco tinnunculus	-0.0207	-0.0200	-0.0176	-0.0186	-0.0193	-0.0145	-0.0175	-0.0187	-0.0168
Galerida cristata	-0.0209	-0.0197	-0.0204	-0.0209	-0.0184	-0.0199	-0.0209	-0.0203	-0.0197
Galerida theklae	-0.0154	-0.0146	-0.0136	-0.0154	-0.0138	-0.0118	-0.0154	-0.0146	-0.0137
Hirundo rustica	-0.0048	-0.0045	-0.0041	-0.0039	-0.0042	-0.0035	-0.0034	-0.0042	-0.0036
Lanius collurio	-0.0038	-0.0038	-0.0024	-0.0023	-0.0038	-0.0010	-0.0015	-0.0029	-0.0019
Lanius senator	-0.0081	-0.0081	-0.0065	-0.0042	-0.0081	-0.0049	-0.0021	-0.0063	-0.0045
Limosa limosa	-0.0391	-0.0363	-0.0391	-0.0391	-0.0336	-0.0391	-0.0391	-0.0382	-0.0372
Melanocorypha calandra	-0.0458	-0.0425	-0.0458	-0.0458	-0.0394	-0.0458	-0.0458	-0.0447	-0.0436
Miliaria calandra	-0.0535	-0.0497	-0.0535	-0.0535	-0.0459	-0.0535	-0.0535	-0.0522	-0.0509
Motacilla flava	-0.0093	-0.0086	-0.0087	-0.0093	-0.0079	-0.0082	-0.0093	-0.0089	-0.0084
Oenanthe hispanica	-0.0106	-0.0100	-0.0092	-0.0106	-0.0094	-0.0078	-0.0106	-0.0099	-0.0093
Passer montanus	-0.0107	-0.0103	-0.0091	-0.0081	-0.0099	-0.0075	-0.0068	-0.0092	-0.0077
Perdix perdix	-0.0215	-0.0202	-0.0202	-0.0210	-0.0189	-0.0189	-0.0207	-0.0205	-0.0194
Petronia petronia	-0.0100	-0.0095	-0.0089	-0.0089	-0.0090	-0.0078	-0.0083	-0.0091	-0.0082
Saxicola rubetra	0.0005	0.0005	0.0016	0.0005	0.0005	0.0027	0.0005	0.0009	0.0013
Saxicola torquata	-0.0156	-0.0156	-0.0098	-0.0156	-0.0156	-0.0039	-0.0156	-0.0137	-0.0117
Serinus serinus	-0.0045	-0.0042	-0.0039	-0.0027	-0.0039	-0.0032	-0.0017	-0.0036	-0.0027
Streptopelia turtur	-0.0030	-0.0028	-0.0024	-0.0018	-0.0025	-0.0018	-0.0011	-0.0023	-0.0016
Sturnus unicolor	-0.0151	-0.0140	-0.0151	-0.0139	-0.0130	-0.0151	-0.0133	-0.0143	-0.0136
Sturnus vulgaris	-0.0202	-0.0188	-0.0202	-0.0189	-0.0174	-0.0202	-0.0182	-0.0193	-0.0184
Sylvia communis	-0.0058	-0.0058	-0.0030	-0.0058	-0.0058	-0.0003	-0.0058	-0.0049	-0.0039
Upupa epops	-0.0080	-0.0077	-0.0071	-0.0067	-0.0074	-0.0062	-0.0060	-0.0072	-0.0063
Vanellus vanellus	-0.0430	-0.0399	-0.0430	-0.0430	-0.0369	-0.0430	-0.0430	-0.0420	-0.0409

Five species are restricted to margin or hedgerow compartments and therefore were not predicted to benefit from cropped area management. Of the remaining 28 species, and considering management options that delivered just one resource type, 11 species benefitted most from management action that delivered only nesting resources, 6 from management actions that delivered only summer foraging resources and 11 from management actions that delivered only winter foraging resources. Increasing the range of resources provided by management actions increased its benefits, in terms of both the number of species affected and the extent of effect. Management actions that provided all three resource types were more beneficial than any single resource providing action for all species.

Annex Table 6: Predicted annual pgr of 33 EFBI species in response to risk mitigation through specific land management options

Each *pgr* is the expected annual change in population size, eg under Scenario 1 the population of *Alauda arvensis* would decline by 4.26% per year. See text for details of scenarios. The management scenario that provides the greatest benefit for each species is highlighted in bold type.

	Scenario 1	Scenario 10	Scenario 11	Scenario 12	Scenario 13	Scenario 14	Scenario 15	Scenario 16	Scenario 17
Alauda arvensis	-0.0426	-0.0385	-0.0344	-0.0405	-0.0383	-0.0391	-0.0358	-0.0328	**-0.0232**
Anthus campestris	-0.0149	-0.0126	-0.0104	-0.0135	-0.0120	-0.0149	-0.0149	-0.0112	**-0.0075**
Anthus pratensis	-0.0255	-0.0236	-0.0218	-0.0243	-0.0231	-0.0226	-0.0199	-0.0196	**-0.0139**
Calandrella brachydactyla	-0.0306	-0.0261	-0.0215	-0.0280	-0.0255	-0.0306	-0.0306	-0.0235	**-0.0164**
Carduelis cannabina	-0.0240	-0.0228	-0.0216	-0.0230	-0.0221	-0.0216	-0.0194	-0.0196	**-0.0153**
Ciconia ciconia	-0.0047	-0.0047	-0.0047	-0.0037	**-0.0027**	-0.0047	-0.0047	-0.0037	**-0.0027**
Corvus frugilegus	-0.0395	-0.0395	-0.0395	-0.0363	-0.0331	-0.0357	-0.0320	-0.0324	**-0.0255**
Emberiza cirlus	-0.0426	-0.0404	-0.0381	-0.0400	-0.0374	-0.0393	-0.0361	-0.0344	**-0.0264**
Emberiza citrinella	-0.0216	-0.0216	-0.0216	-0.0200	-0.0185	-0.0192	-0.0169	-0.0176	**-0.0138**
Emberiza hortulana	-0.0050	-0.0034	-0.0018	-0.0047	-0.0044	-0.0050	-0.0050	-0.0031	**-0.0012**
Falco tinnunculus	-0.0207	-0.0207	-0.0207	-0.0198	-0.0189	-0.0198	-0.0189	-0.0189	**-0.0171**
Galerida cristata	-0.0209	-0.0198	-0.0187	-0.0197	-0.0185	-0.0195	-0.0182	-0.0172	**-0.0135**
Galerida theklae	-0.0154	-0.0143	-0.0132	-0.0148	-0.0141	-0.0146	-0.0138	-0.0128	**-0.0102**
Hirundo rustica	-0.0048	-0.0048	-0.0048	-0.0042	-0.0035	-0.0048	-0.0048	-0.0042	**-0.0035**
Lanius collurio	**-0.0038**	**-0.0038**	**-0.0038**	**-0.0038**	**-0.0038**	**-0.0038**	**-0.0038**	**-0.0038**	**-0.0038**
Lanius senator	**-0.0081**	**-0.0081**	**-0.0081**	**-0.0081**	**-0.0081**	**-0.0081**	**-0.0081**	**-0.0081**	**-0.0081**
Limosa limosa	-0.0391	-0.0335	-0.0279	-0.0358	-0.0326	-0.0391	-0.0391	-0.0303	**-0.0214**
Melanocorypha calandra	-0.0458	-0.0412	-0.0367	-0.0429	-0.0399	-0.0431	-0.0407	-0.0357	**-0.0257**
Miliaria calandra	-0.0535	-0.0484	-0.0433	-0.0505	-0.0476	-0.0495	-0.0457	-0.0415	**-0.0297**
Motacilla flava	-0.0093	-0.0074	-0.0056	-0.0087	-0.0081	-0.0093	-0.0093	-0.0068	**-0.0044**
Oenanthe hispanica	-0.0106	-0.0094	-0.0083	-0.0099	-0.0091	-0.0106	-0.0106	-0.0087	**-0.0068**
Passer montanus	-0.0107	-0.0107	-0.0107	-0.0107	-0.0107	-0.0095	-0.0084	-0.0095	**-0.0084**
Perdix perdix	-0.0215	-0.0204	-0.0193	-0.0206	-0.0197	-0.0195	-0.0176	-0.0175	**-0.0136**
Petronia petronia	-0.0100	-0.0100	-0.0100	-0.0094	-0.0087	-0.0094	-0.0087	-0.0087	**-0.0074**
Saxicola rubetra	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**
Saxicola torquata	**-0.0156**	**-0.0156**	**-0.0156**	**-0.0156**	**-0.0156**	**-0.0156**	**-0.0156**	**-0.0156**	**-0.0156**
Serinus serinus	-0.0045	-0.0045	-0.0045	-0.0042	-0.0038	-0.0041	-0.0036	-0.0037	**-0.0029**

Streptopelia turtur	-0.0030	-0.0030	-0.0030	-0.0024	-0.0018	-0.0030	-0.0030	-0.0024	**-0.0018**
Sturnus unicolor	-0.0151	-0.0151	-0.0151	-0.0137	-0.0124	-0.0137	-0.0123	-0.0123	**-0.0096**
Sturnus vulgaris	-0.0202	-0.0202	-0.0202	-0.0186	-0.0171	-0.0180	-0.0159	-0.0164	**-0.0128**
Sylvia communis	**-0.0058**	**-0.0058**	**-0.0058**	**-0.0058**	**-0.0058**	**-0.0058**	**-0.0058**	**-0.0058**	**-0.0058**
Upupa epops	-0.0080	-0.0080	-0.0080	-0.0073	-0.0065	-0.0080	-0.0080	-0.0073	**-0.0065**
Vanellus vanellus	-0.0430	-0.0391	-0.0351	-0.0407	-0.0384	-0.0395	-0.0361	-0.0332	**-0.0236**

Predicted EFBI levels under each scenario were calculated based on the population trends of these 33 species[53]. Initially, we calculated EFBI in 2020, using predicted *pgr* under current conditions were applied for the period 1980-2013 and predicted *pgr* under scenario conditions were applied from 2014-2020. However, the relatively short period for the scenarios, under which differing *pgr* were operating, meant that differences in predicted EFBI were small. We therefore extended the period to estimate EFBI in 2035 and the results are presented in Annex Table 7. Even with this extended period the differences between the EFBI scores in 2035 are relatively small. This reflects the significant impacts of ongoing pressures on species and the large influence of the extent of management actions, which were constrained to a maximum of 10%.

Annex Table 7: Predicted EFBI values in 2035 under each Scenario

Scenario	Predicted EFBI in 2035	Range		Scenario	Predicted EFBI in 2035	Range
1	0.37	(0.25-0.53)		1	0.37	(0.25-0.53)
2	0.39	(0.26-0.55)		10	0.39	(0.26-0.55)
3	0.38	(0.24-0.55)		11	0.40	(0.26-0.58)
4	0.38	(0.26-0.55)		12	0.38	(0.24-0.56)
5	0.39	(0.25-0.58)		13	0.39	(0.27-0.56)
6	0.39	(0.25-0.55)		14	0.38	(0.26-0.55)
7	0.39	(0.25-0.56)		15	0.39	(0.26-0.55)
8	0.38	(0.26-0.55)		16	0.40	(0.27-0.59)
9	0.39	(0.26-0.56)		17	0.44	(0.30-0.62)

Under each land management scenario the predicted EFBI was lower than the modelled EFBI level for 2005 of 0.66 and the observed index calculated from actual population growth rates of 0.64. Thus the EFBI farmland bird populations are expected to continue to decline. However, the EFBI was higher under each scenario than if current conditions persist (ie under Scenario 1). But importantly, in terms of EFBI levels, allocating more land and targeting efforts towards resource delivery in the cropped area had the greatest benefit. Scenario 17, where 10% land was allocated to beneficial cropped area management and all three resource types were delivered was the most beneficial of all scenarios tested, with the

[53] Each predicted *pgr* is actually the mean of a distribution of possible values described by this mean and its associated standard deviation. To calculate confidence intervals in the predicted EFBI, we first generated a distribution of predicted *pgr* for each species based on the jack-knifed models. Next, we randomly sampled a population growth rate from each distribution and used these growth rates to calculate the predicted EFBI using the same methods that are used to calculate the actual EFBI (Gregory *et al,* 2005). We repeated this bootstrapping process 1000 times to generate a distribution of predicted EFBIs, from which we estimated the mean. The 25th and 975th EFBI values of the 1000 bootstrapped samples, when ordered by size, were used to estimate the 95% confidence limits of this mean EFBI.

EFBI in 2035 7% higher than if current conditions persist. However, whilst all scenarios were favourable compared to Scenario 1, most benefits were slight and none was sufficient to halt farmland bird declines. This reflects the assumption discussed above that risk offsets will be proportional to the amount of land under conservation management measures. Therefore, although there are considerable uncertainties, the results suggest that carrying out generic management that is broadly applied, as under the scenarios explored will be insufficient to offset risks to EFBI species accrued from on-going agricultural change, even if 10% of farmland is allocated to them. Either additional land under these types of conservation management would be required and/or more efficient land management actions used that require less land for offsetting risks than is impacted by agricultural changes. Targeting can also reduce the extent of land required by helping to ensure that management actions are undertaken only where they are needed and appropriate.

These trait-based modelling results broadly accord with the results of a recent study by the Netherlands Environmental Assessment Agency that used a different modelling approach to assess the potential biodiversity impacts of CAP Greening measures (Zeijts *et al,* 2011). The study used the Common Agricultural Policy Regionalised Impact Modelling System (CAPRI) and the Dyna-CLUE (Conversion of Land Use and its Effects) model to develop spatially specific projections of land use change and intensification for 2020 according to a business as usual baseline scenario and a Greening Scenario, which was based on Option 2 of the European Commission's 2010 CAP reform proposals (European Commission, 2010i). Areas of semi-natural habitat were excluded from the analysis. Impacts on species richness (across 145 selected animals and plants) were then assessed by linking the land use change projections to a spatial database of potential species richness and sensitivity to selected agricultural pressures[54].

The study concluded that their Greening Scenario would be likely to result in a 3.3% increase in species richness compared with the Baseline Scenario by 2020 on EU farmland (3.1% on arable land and 3.9% on grassland, excluding semi-natural habitats). The study did not provide a comparison of the projected species richness with current species richness. Half the projected relative increase in species richness on arable land was attributed to the introduction of ecological set-aside over 5% of the arable area in the Greening Scenario. The Greening Scenario also included an assumed increase in agri-environment funding (due to a 5% budgetary shift from Pillar 1 to Pillar 2 in the EU-15) and a payment to encourage the maintenance of permanent grassland. The study's results suggested that the increase in agri-environment funding would be the main driver of the relative increase in species richness on grassland, with the measure to maintain permanent grassland having little additional impact.

The results cannot be directly compared with those of the trait-based modelling of birds because they cover a wider range of taxa, and relate to species richness rather than species populations. Increases in species richness are likely to be correlated to some degree, but may reflect increases in generalist common species rather than specialist farmland species covered by the EFBI. Furthermore the results should be treated with some caution because

[54] Based on www.BIOSCORE.eu

the mix of measures in the Greening Scenario is difficult to compare with the trait-based modelling study and are significantly different from the Commission's formal proposals for the CAP reform (European Commission, 2010i) The modelling of the relationship between species and agricultural intensification is also rather simplistic and does not take into account many of the identified impacts of changes in agricultural practice on biodiversity, which are better captured in the trait-based modelling approach. Nevertheless, the results for arable farmland provide some support for the conclusions from the trait-based modelling that generic management measures will need to cover more than 10% of arable land, or be more efficient and targeted to halt the loss of biodiversity on farmland.

9.10 Annex 2.10: External impacts of agriculture

9.10.1 Impacts of diffuse water pollution

Diffuse pollution from agriculture is a major cause of poor water quality in Europe (EEA, 2010b). In particular nutrients, nitrogen and phosphorous, from fertilisers and manure are regularly detected in fresh and coastal waters at levels sufficient to impact aquatic ecosystems. The impact of excessive nutrient levels in water bodies is eutrophication, characterised by the proliferation of algal blooms leading to the loss of desirable plant and animal species. Additionally, as algal blooms die away they generate a large amount of organic matter and oxygen levels are diminished. Inorganic mineral fertilisers and organic manure from livestock are typically the major nutrient inputs to agricultural land, and inputs which are generally in excess of crop and grassland requirements (EEA, 2010b). The higher the nutrient surplus is, the higher the potential for transport to water bodies and therefore eutrophication.

Despite recent general declines in the nitrogen and phosphorous surplus, in some regions of Europe levels remain excessively high. Agricultural emissions of nitrogen to freshwater are estimated to exceed 10 kg/ha/year across some European regions, with values reaching more than 20 kg/ha/year in parts of Denmark, southern Sweden, western UK, Ireland, Belgium, the Netherlands, Brittany and the Po Valley. Agricultural phosphorous emissions follow a broadly similar distribution with values exceeding 0.1 kg/ha/year across much of Europe but exceeding 1.0 kg/ha/year in hotspots. Furthermore, reporting under the Nitrates Directive shows that 33% of the surface water stations that monitor trophic status across Europe classify the water status as eutrophic or hypertrophic.

The most common effects of increased nitrates and phosphates on aquatic ecosystems are increases in the abundance of algae and aquatic plants and modified community structure of both suspended and benthic algae (Smith *et al,* 1999; Smith, 2003). Dense algal mats reduce the quality of habitat for macro-invertebrates and fish spawning. Eutrophic lakes are typically characterised by shifts towards dominance of the phytoplankton by bloom-forming blue-green algae (cyanobacteria) some of which produce highly toxic compounds, thereby increasing the probability of fish kills. Eutrophication can also be responsible for harmful diel fluctuations in pH and in dissolved oxygen concentrations (Smith *et al,* 1999). The response of a waterbody to nutrient inputs may be profoundly altered by food-web structure. For example, Lago Maggiore in Italy experienced major changes in the pelagic community from the mid 1980's to mid 1990's. These changes included shifts in planktonic species composition, but also changes in communities of planktonic vertebrates and fish. It was concluded that changes in abundance and average cell size may have resulted from changes in the structure of the lake's food web (Smith *et al,* 1999).

A very large proportion of the nutrients exported from the land surface to streams and rivers ultimately make their way to the sea (Smith, 2003), and the occurrence of eutrophication has been documented for all European seas with severe cases being reported for the Baltic, North Seas and several coastal lagoons in the Mediterranean (EEA, 2001a). In coastal waters eutrophication results in excessive growth of plankton algae, thereby increasing levels of organic matter. The consequent increase in oxygen consumption can, in areas with stratified water masses, lead to oxygen depletion, changes to community structure of benthic fauna and death of demersal fish (EEA, 2001a). Eutrophication can also promote the risk of harmful algal blooms causing the death of benthic fauna (EEA, 2001a).

There are a number of other pollutants from agriculture that affect Europe's water quality and aquatic ecosystems (eg sediment, pesticides, some pathogenic micro-organisms, heavy) although good pan-European information on their emissions is not available (EEA, 2010b). Excessive sediment is damaging because it smothers spawning grounds for fish and damages their gills, and it transports nutrients, pesticides and microbes to waterways (EEA, 2010b). Pesticides can also be harmful to aquatic biota. They have been shown to interfere with respiration, photosynthesis, cell growth and division in aquatic micro-organisms and seen to impair the nervous systems of fish (EEA, 2010b). Endocrine disrupting chemicals are other pollutants that have been documented to adversely affect fish populations, particularly through the feminisation of male fish, including feminised reproductive tissue and reduced fertility. Although mainly discharged from sewage treatment plants, pesticides, fungicides, insecticides and cattle feedlot effluent are all potentially endocrine disrupting (EEA, 2010b; Matthiessen *et al,* 2006).

9.10.2 Impacts of water abstraction

The agricultural sector accounts for 22% of Europe's freshwater abstraction, but this figure rises for the southern European countries (up to 80% in some) (EEA, 2010c). Despite recent declines in water abstraction for irrigation, levels continue to be excessive (EEA, 2009b). Because over-abstraction frequently results in reduced river flows, lower lake and groundwater levels and the drying of wetlands it has important implications for biodiversity. Rivers require a sufficient amount of water ('environmental flow') in order to maintain a healthy aquatic ecosystem, including freshwater invertebrates, vegetation and riparian bird life. The tolerance of aquatic biota to changes in river flow, velocity and depth, water quality, cover and substrate varies between species. However low-flows represent a particular risk to migratory fish that require sufficient flow in order to trigger upstream movement towards spawning grounds and sufficient velocity and depth in order to drift-feed (EEA, 2009b). Low-flows can result in deposition of sediment (thereby reducing available fish spawning habitat and invertebrate refuges) and may increase water temperature (which can affect metabolic processes and dissolved oxygen levels). Generally, low velocity and oxygen levels lead to shifts in invertebrate assemblages and fish communities from species which favour clean, well-oxygenated water to more generalist species (Salmon and Trout Association, 2010).

9.10.3 Impacts of airborne ammonia pollution

The volatization of ammonia emitted from intensive agricultural systems, and consequent transport and deposition of atmospheric nitrogen on non-agricultural ecosystems, has a major impact on European biodiversity (Ellenberg *et al,* 1989). The largest sources of agricultural atmospheric ammonia emissions are from livestock and their wastes – ammonia is derived mainly from the decomposition of urea in animal wastes and uric acid in poultry wastes – but other agricultural sources include fertiliser use, crops, and crop decomposition (NEGTAP, 2001). The availability of nutrients is a determining factor in the species composition of ecosystems, with nitrogen being the limiting nutrient for plant growth in many natural and semi-natural ecosystems. Thus most plant species of natural and semi-natural ecosystems are adapted to, and can only survive or compete successfully in, nutrient-poor conditions, and therefore increased inputs of airborne nitrogen can lead to severe and complex changes in the structure and functioning of ecosystems (Bobbink and Lamers, 2002; NEGTAP, 2001). In close proximity to the sources of emissions acute exposure to ammonia can result in visible foliar injury on vegetation (Krupa, 2003). Ammonia is deposited rapidly within the first 4 to 5 km from its source, so vegetation within this approximate radius might suffer symptoms such as discolouring of the leaves, needle loss in conifers, and eventually death (Krupa, 2003).

Ammonia emissions can also cause serious effects at greater distances through airborne eutrophication, although high variation in sensitivity to nitrogen deposition has been observed between different ecosystems. In raised bog ecosystems high ammonium deposition (over ca. 10-15 kg N/ha/yr) has been observed to result in a decline in the original *Sphagnum* (peat mosses) bog vegetation, and an increase in more nitrogen-dependent Sphagnum species (eg *S. recurvum*), shallow rooting vascular plants (eg *Eriophorum* and *Molinia caerulea*) and trees (*Betula pubescens*), thereby reducing typical plant diversity (Bobbink & Lamers, 2002). In heathland ecosystems, characterised by small-leaved evergreen dwarf shrubs (especially *Calluna vulgaris*) with a ground layer of mosses and lichens, nitrogen enrichment has be observed to increase plant productivity of the dwarf shrub species, and other invasive nitrophilous species (eg grasses). *Calluna* can continue to out-compete grasses at high nitrogen loads as long as the canopy remains closed. However, many heathlands have sparse *Calluna* cover as a result of overgrazing grazing and/or burning (Hester, 1996; Shaw *et al,* 1996; Tucker, 2003). Furthermore evidence suggests that the biochemical changes to plant tissue may increase frost sensitivity and herbivory (eg heather beetle/ winter moth outbreaks), which open the canopy and enhance the competitiveness of invasive grasses (Bobbink & Lamers, 2002; NEGTAP, 2001). The disappearance of mosses and lichens from under the canopy has also been observed, resulting from light deprivation and enhanced litter accumulation (Bobbink & Lamers, 2002; NEGTAP, 2001).

Species-rich grasslands are another ecosystem sensitive to airborne eutrophication. Because they are generally nutrient poor and highly diverse, fertilisation has to be avoided in order to maintain their high species diversity. Declines in the characteristic herbaceous species and increases in grasses have been observed in calcareous to acidic grasslands, although the effects of ammonium accumulation in the soil are more severe in acidic grasslands (which have a lower acidification buffering capacity) (Bobbink & Lamers, 2002).

10 ANNEX 3 – EU LEGISLATIVE MEASURES FOCUSSED ON BIODIVERSITY

Annex Table 8: EU legislative measures relevant for delivery of biodiversity benefits

Measures with a DIRECT FOCUS on the preservation of biodiversity and habitats and habitats				
	Article	**Measures**	**Does it apply to land management at farm level?**	**CAP instrument in which the legislative measure must or can be integrated**
Birds directive[1]	Art 3 (1)	To maintain a sufficient diversity and area of habitats for all the species of birds referred to in Article 1 of the Directive[55] at a level which corresponds in particular to ecological, scientific and cultural requirements.	Y	SMR1, 213, 214, 216
	Art 3(2)(b)	To ensure upkeep and management in accordance with the ecological needs of habitats inside and outside the protected zones (Special Protection Areas (SPAs) designated under Article 4 of the Directive.	Y	SMR1 213, 214, 216
	Art 4(1) and 4((2)	To protect species listed in Annex I through conservation management measures in Special Protection Areas (SPAs) and the migratory species of birds not listed in Annex I through conservation management measures in their breeding, moulting and wintering areas.	Y	SMR1, 213, 214, 216
	Art 4(4)	To avoid pollution or deterioration of habitats or any disturbances affecting the birds, if these significantly affect the objectives of the directive, inside and outside the protected zones through appropriate measures.	Y	SMR1, 213, 214, 216
	Art 5(a), (b) and (d)	To prohibit (a) deliberate killing or capture; (b) deliberate destruction of, or damage to nests and eggs; (d) deliberate disturbance of these birds particularly during the period of breeding and rearing, through protection measures for all species of birds referred to in Article 1.	Y	SMR1, 213, 214, 216
Habitats Directive[2]	Art 3(1)	To maintain or restore, at favourable conservation status, natural habitats and species of wild fauna and flora of Community interest[56]	--	--
	Art 3(1)	To create a wider environment to maintain coherent European ecological network related to special areas of conservation under Natura2000, if appropriate also outside the protected zones.	--	--
	Art 3(3)	To improve the ecological coherence of Natura 2000 by maintaining, and where appropriate developing, features of the landscape which are of major importance for wild fauna and flora, as referred to in Article 10.	Y but not exclusively	GAEC; 213, 214, 216
	Art 4	To protect Special Areas of Conservation (SACs) designated by Member States (for habitats and species of Community interest).	--	--
	Art 6	To set up, if appropriate, management plans involving measures specifically designed for the sites or integrated into other development plans, and appropriate statutory, administrative or contractual standards measures which correspond to the ecological requirements of the natural habitat types in Annex I and the species in Annex II present on the sites; to define the meaning of ecological requirements relevant to habitats, water, soil,	Y but not exclusively	SMR5, 213, 214, 216

55 All species of naturally occurring birds in the wild state in the European territory of the Member States to which the Treaty applies.

56 These are habitats and species that are listed in Annex I and II of the Directive respectively.

		and air where relevant; to operationalise these management measures.		
	Art 10	To improve the ecological coherence of the Natura 2000 network, if necessary, through land-use planning and development measures; through management of landscape features and management of stepping stones (such as ponds or small woods) which are essential for the migration, dispersal and genetic exchange of wild species, if appropriate.	Y but not exclusively	213, 214, 216
	Art 13(1)(a)	To establish a system of strict protection for the plant species listed in Annex IV (b), prohibiting the deliberate picking, collecting, cutting, uprooting or destruction of such plants in their natural range in the wild.	Y	SMR5, 213, 214, 216
Environmental liability directive[3]	Art 1 and Art 2	To establish a framework for preventing and remedying environmental damage based on the "polluter pays" principle, involving direct or indirect damage to species and habitats protected under the Birds and Habitats Directives (besides land damage and water damage).	--	Design of GAEC and rural development plans
	Art 3	To carry out a 'strict' liability scheme including preventive and restorative measures with impact on species and habitats. This liability scheme concerns activities listed in Annex III, including for example certain water abstraction projects and projects involving use of certain plant protection products, which require a license on integrated pollution prevention and control[57].	Y but not exclusively	--
	Art 5 and Art 6	To take the necessary preventive measures where there is potential threat of environmental damage, and necessary restorative measures where the damage has occurred. The responsibility should be taken and costs borne by the operator (the potential polluter) or the competent authority designated by each Member State (who may recover the costs incurred at a later date). The restorative measures should aim at restoring the environment to how it was before the damage, and the damaged natural resources should be replaced by identical, similar or equivalent natural resources at the site proper or, if necessary, at an alternative site.	Y but not exclusively	SMR1, SMR5, GAECs, 213 and 214*; 125, 216, 323**
Renewable Energy Directive[4]	Art 17(3)(b) (c) and Art 17(6)	To comply with a set of the 'sustainability criteria' if the biofuels produced of agricultural feedstocks are meant to count towards the national target; in particular the criterion excluding agricultural feedstocks from land with high biodiversity value, such as land within designated protected areas, land recognised internationally for the protection of rare, threatened or endangered ecosystems, and from highly biodiverse grassland (meaning only natural or species-rich and not degraded semi-natural grasslands); as well as the criterion stressing the binding nature of cross-compliance requirements and standards.	Y but not exclusively	--
Measures with NO DIRECT FOCUS but that may have a positive impact on the preservation of biodiversity and habitats				
Nitrates directive[5]	Art 3	To identify waters that are polluted or at risk for pollution; to establish designate vulnerable zones (areas that drain into identified waters).	--	--
	Art 4 and Art 5	To establish codes of good agricultural practices and action programmes (a set of measures to prevent and reduce nitrate pollution); to review at least every 4 years of the designation of vulnerable zones and action programmes; to undertake water monitoring (with regard to nitrate concentration and trophic status).	--	SMR4
	Art 5	To implement measures under the action programmes	Y	SMR4
Water Framework Directive[6]	Art 4	To prevent deterioration of the status of surface and groundwater; to protect, enhance and restore surface and groundwater with the aim of achieving good surface water status by 2015.	--	--
	Art 5 and Art 13	To characterise the river basin (or its relevant part); to review the impact of human activity on the status of surface waters and on groundwater; and to set out measures to achieve the good surface and groundwater status by 2015; to develop river basin management plans, including the programme of measures.	--	--

[57] Council Directive 96/61/EC of 24 September 1996 concerning integrated pollution prevention and control

	Art 10	To establish programme of measures, including ‘basic’ and ‘supplementary’ measures for each river basin (or its relevant part); under ‘basic’ measures, to promote an efficient and sustainable water use; to safeguard water quality; to control the abstraction of fresh surface water and groundwater and register water abstractions. Under ‘supplementary measures’, eg to restore wetlands, to promote, if appropriate, adapted agricultural production such as low water requiring crops and water-saving irrigation techniques.	(from 2012 may apply at farm level where relevant)	GAEC, 121, 213, 214, 125, 216, 323
Framework Directive on Sustainable Use of Pesticides[7]	Art1 and Art4	To achieve sustainable use of pesticides by reducing the risk of and impacts of pesticide use on human health and the environment, promoting the use of integrated pest managements and alternative approaches to plant protection; to adopt National Action Plans including quantified objectives, targets, measures and timetables to reduce pesticide risk	--	--
	Art 5, 8, 11	To ensure appropriate training for professional users (farmers); to carry out regular inspections of pesticide application equipment in use; to protect aquatic environment through appropriate measures;	Y but not exclusively	--
	Art 9, 11, and 13	To undertake no aerial spraying (except for cases established through derogation); to ensure that on-farm operations such as handling, dilution, mixing of pesticides, handling of packages, disposal of remaining mixture and cleaning of equipment do not pose a threat to health and environment	Y	--
	Art 14, annex III	To promote low pesticide use through integrated pest management, giving preference to non-chemical methods In 2014, general principles of IPM mandatory for all farmers	Y	--
EIA Directive[8]	Art 2	To ensure that projects likely to have significant effects on the environment because of their nature, size, location etc, undergo an ex-ante assessment of their effects, and an approval by relevant authorities is given before their onset. These projects are listed in Annexes I and II.	--	--
	Art 3	Through ex-ante impact assessment of the defined projects, on case-by-case basis, to identify, describe and asses, the direct and indirect effects of a project on the factors regarding (a) human beings, fauna and flora; (b) soil, water, air, climate and the landscape; (c) material assets and the cultural heritage; and interaction between these. Implemented with a link to Art 6 (3) and (4) of the Habitats Directive.	--	121, 125, 221, 322, 323
	Art 4	To make assessments on a mandatory basis for Annex I projects and on the basis of discretion by Member States in Annex II projects. These include agriculture projects, for example projects for restructuring of the rural land holdings; for the use of uncultivated land or semi-natural areas for intensive agricultural purposes; afforestation, pi-rearing and chicken-rearing installations; as well as energy projects. For these, to determine the thresholds and criteria in respect of the requirements of the Directive at Member State level in order to determine the types of projects subject to ex-ante assessment.	--	121, 125, 221, 322, 323***
RED[3]	Art 17(4)	To comply with a set of the ‘sustainability criteria’, in particular the ban on use of agricultural feedstocks from land with high carbon stock, such as wetlands, and from land that was peatland in January 2008.	Y	--

Notes:

1. Directive 2009/147/EC of the European Parliament and the Council of 30 November 2009 on the conservation of wild birds
2. Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora
3. Directive 2004/35/EC of the European Parliament and the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage
4. Directive 2009/28/EC of of the European Parliament and the Council of 23 April 2009 on the promotion of the use of energy from renewable sources
5. Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources
6. Directive 2000/60/EC of of the European Parliament and the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy
7. Directive 2009/128/EC of the European Parliament and the Council of 21 October 2009 establishing a framework for community action to achieve the sustainable use of pesticides
8. Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment

*CAP measures relevant for preventive actions

** CAP measures relevant for restorative actions

*** These measures might need to be subject to EIA regulations in different countries.

11 ANNEX 4 - STANDARDS OF GOOD AGRICULTURAL AND ENVIRONMENTAL CONDITION FOCUSSED ON BIODIVERSITY IN CASES TUDY AREAS

Annex Table 9:Compulsory standards for Good Agricultural and Environmental Condition focussed on biodiversity in case study areas

GAEC STANDARD 58	MS	DESCRIPTION OF THE SPECIFIC MEASURES SET AT THE NATIONAL LEVEL	IMPACT AND EFFECTIVENESS ON THE GROUND	POSSIBLE SYNERGIES WITH WATER AND SOIL MANAGEMENT
Retention of landscape features	CZ	Those not included in SMR, defined and designated in LPIS.	Effective in damage prevention, could be more flexible	No particular additional benefit
	EL	Landscape features such as hedges, ditches and trees in line or in groups, within the parcel or in the margin should not be destroyed. Additionally as for pasture land, rocks and boulders are also considered landscape features.	N.A.	N.A.
	FR	Maintain the perennial characteristics of the countryside (hedges, patches of trees, etc.) All farms which have requested aid subject to cross-compliance and which own agricultural land are concerned, except those where useful agricultural land is less than or equal to 15 ha. These elements should represent a total of 1% of the utilised agricultural area (UAA) of the farm in 2010, 3% in 2011. Farmers who do not meet this level must therefore plant the landscape features. The various landscape features which may be retained are listed in Annex III.	These semi-natural environments, which are essential to implementing a sustainable development policy, provide habitats, transition areas and displacement corridors to encourage diversity of vegetable and animal areas (and particularly crop growing auxiliaries).	N.A.
	UK	GAEC 14 Protection of hedgerows and watercourses *Must not cultivate or apply fertilisers/pesticides to land within 2m of the centre of a hedgerow.* *Must maintain a green cover on land within 2 metres of the centre of a hedgerow.*	N.A.	Reduced inputs applied to land adjacent to water courses. Reduced erosion of banks through machinery restrictions of a minimum distance.

[58] According to Annex III of Council Regulation EC 73/2009

		GAEC 15 Hedgerows (on removal, cutting or trimming). *Must not cut or trim any hedgerow on your farm between 1 March and 31 July each year (the main breeding season*). GAEC 16 Felling of trees. GAEC 17 Tree Preservation Orders.		Maintenance of hedgerows will act as a windbreak to prevent wind erosion of soils and may act as a water sink or barrier in times of heavy rainfall.
	DE	It is prohibited to eliminate the following landscape features totally or partly: single trees, row of trees, hedgerows or walled hedges, spinneys or small woods, small wetlands.	Landscape elements have an outstanding importance as habitats for many species and contribute significantly to landscape.	Maintenance of hedgerows etc. will act as a windbreak to prevent wind erosion of soils and may act as a water sink or barrier in times of heavy rainfall.
	RO	Cutting down solitary trees and/or a group of trees grown on the agricultural land is not permitted.	Positive impact especially for insects and birds	Low synergetic effect with water and soil management
Avoiding the encroachment of unwanted vegetation	CZ	Designed as a minimum cutting/grazing regime.	May be 'too effective', farmers tend to mulch grass to avoid non-compliance.	Slowing down the water run off a little.
	EL	Proceed in the necessary farming interventions in the parcel in order to maintain it in good conditions and avoid invasion of undesirable species. farmers can remove the undesirable vegetation either by grazing or with mechanical weeding and removal.	N.A.	N.A.
	FR	Cultivated land, including grassland: land density must comply with local practices to allow uniform coverage and covering, and being maintained in such a way that it allows for flowering. These rules may be supplemented at local level. Set-aside land: obligation for vegetation cover between 1 May and 31 August, for minimum maintenance (no undesirable species appearing, no fertilisation other than 50 units of nitrogen to ensure the growth of the cover, compliance with the ministerial decree of 26 March 2004 on the ban on grinding or mowing during a period of 40 days fixed by prefectural order between 1 May and 15 July, etc.)	N.A.	N.A.

	UK	GAEC 10 Heather and grass burning. *Must not burn heather, rough grass, bracken, gorse or vaccinium outside the burning season.* GAEC 11 Control of weeds. GAEC 12 Agricultural land which is not in agricultural production. *Must not cut down or plough vegetation on the land* N.A. *between 1 March and 31 July.*		GAEC 12 Reduced fertiliser and input application to land contributing towards the protection of water quality.
	DE	On arable land withdrawn from agricultural production passive or active greening has to be allowed for. Upcoming vegetation has to be cut and mulched yearly, or mowed and removed from the land every second year. On permanent pastures withdrawn from production the growth has to be cut and spread on the whole surface at least once a year or otherwise the growth has to be cut every second year and be removed from the land. Between 1 April and 30 June these measures are forbidden.	Contributing to the maintenance of certain biotopes (habitats).	N.A.
	RO	The installing of unwanted vegetation on agricultural lands, including lands that are not used in production must be avoided.	Very important standard to be respected on grasslands because cutting down unwanted vegetation allows the existence of different grasslands species to grow.	Low synergetic effect with water and soil management.
Minimum soil cover	CZ	Minimum soil coverage or manure application. The applicant, on an arable land block or a part thereof whose average incline exceeds 7 degrees, is required to sow the next crop after the harvest or to apply at least one of the following measures: a) stubble is to be left on the land block or part thereof until 30th November at latest, or b) the soil is to remain ploughed, or at least tilled for the purpose of water absorption until 30th November at latest.	Better diversity of fodder on arable land.	Builds humus in soil, water run off prevention.
	EL	Parcels on soil with more than 10% slope gradient should be covered by vegetation or stubble through the rainy period of the year.	N.A.	N.A.

	FR	Cultivated land, including grassland: land density must comply with local practices to allow uniform coverage and covering, and being maintained in such a way that it allows for flowering. These rules may be complemented at local level. Set-aside land: cover obligation between 1 May and 31 August. Single-crop farming undertaking (95% of the soil cultivated used for the same crop): obligation to provide winter cover between 1 November and 1 March. (c.f. standards for crop rotations subsequently).	N.A.	N.A.
	UK*	GAEC 1 Soil Protection Review . *Where organic matter is low, introduce cover crops or grass leys into the rotation.* *Following harvest, sow the next crop within 10 days of having been prepared as a seedbed where weather conditions allow.* *Undersow maize.* *Temporary cover crop throughout winter.* If land has carried a crop of oil-seeds, grain legumes or cereals (other than maize) which has been harvested by either combine harvester or mower, then: *Must* meet one of the following conditions from the first day after harvest until the last day of February in the following year: the stubble of the harvested crop remains in the land; the land is left with a rough surface following operations such as ploughing, disking or tine cultivation; the land is under cultivation sequences used to create stale seedbeds; the land is sown with a temporary cover crop. If this becomes grazed out or cultivated out during the post-harvest period, a rough surface must be left as soon as conditions permit; the land is sown with a crop within 10 days of having been prepared as a seedbed.	N.A.	N.A.
	DE	Restriction on ploughing in winter in erosion (wind/water) sensitive areas.	N.A.	N.A.
	RO	n/a	N.A.	N.A.
Establishment	CZ	Not applicable.	N.A.	N.A.

of buffer strips along watercourses (from 2012)	EL	Not implemented yet.	N.A.	N.A.
	FR	5 m min. along all water courses present on the farmland. Fertilisation and PPPs on buffer strips in banned.	N.A.	Avoid nutrient leaching and prevent from applying PPPs too close from water course.
	UK	GAEC 14 Protection of hedgerows and watercourses. *Must not cultivate or apply fertilisers or pesticides to land:* *- within 2m of the centre watercourse or field ditch;* *- between the edge of the watercourse or field ditch and 1m on the landward side of the top of the bank.* *Must maintain a green cover:* *- within 2m of the centre, watercourse or field ditch;* *- between the edge of the watercourse or field ditch and 1m on the landward side of the top of the bank.*	N.A.	Reduced inputs applied to land adjacent to water courses. Reduced erosion of banks through machinery restrictions of a minimum distance. Maintenance of hedgerows will act as a windbreak to prevent wind erosion of soils and may act as a water sink or barrier in times of heavy rainfall.
	DE	Not available.	Reduction of contamination (fertilizers, pesticides) of ecosystems and habitats bound to flowing waters (and marine ecosystems).	Protection of water bodies against contamination.
	RO	n/a (Not yet elaborated)	N.A.	N.A.

* GAEC 1 (2010) includes former GAEC 1 the Soil Protection Review, GAEC 2 Post Harvest Management of Land, GAEC 3 Waterlogged soil and GAEC 4 Crop residue burning restrictions.

Source: Case study reports; Member States notifications on GAEC standards to the European Commission.

Annex Table 10: Optional standards of Good Agricultural and Environmental Condition focussed on biodiversity

GAEC STANDARD	MS	DESCRIPTION OF THE SPECIFIC MEASURES SET AT THE NATIONAL LEVEL	IMPACT AND EFFECTIVENESS ON THE GROUND	POSSIBLE SYNERGIES WITH WATER AND SOIL MANAGEMENT
Minimum stocking rates or appropriate regimes	UK	GAEC 9 - Overgrazing *Must not* 1. overgraze, or allow to be overgrazed, the natural and semi-natural vegetation on your holding; 2. carry out unsuitable supplementary feeding, except where it is necessary for the purpose of animal welfare, during periods of extreme weather conditions. *Must* comply with any written directions, in relation to land subject to overgrazing and/or unsuitable supplementary feeding, sent to you on behalf of the Secretary of State.	N.A.	Potential to reduce poaching in areas of high livestock density particularly adjacent to water sources or entry areas.
	DE	Maintenance obligation where no agricultural production takes place: (self-) greening (arable land) and annual mulching and mowing (arable land and permanent pasture). Periods in which mulching, chopping and mowing are banned from 1 April to 30 June for environmental reasons. On arable land and permanent pasture taken out of agricultural production, at least once a year the young growth is to be cut back and spread over the whole area (mulching or chopping) or at least every two years is to be mown and the mowing's taken away from the area.	N.A.	N.A.
	FR	Compliance with the following on the farm is checked: A minimum load established at national level of 0.2 UGB/ha, calculated for grass surface areas of the farm. This limit can be adapted by prefectural decree for less productive areas of the department; or A minimum yield level for areas sown with grass, defined by prefectural decree for farms marketing all or part of their grass production This limit can be adapted for less productive areas of the department.	N.A.	N.A.

	EL	Minimum level of grazing density 0,2 animal units. - Maximum level of grazing density 3 animal units. In private permanent pastures the owners should take care that the undesirable wooden plants are removed.		
	RO	Maintaining permanent grassland by providing a minimum level of grazing or mowing at least once a year.	In line with traditional management of grasslands.	Low synergetic effect with water and soil management
Establishment or retention of habitats	UK	GAEC 5 - EIA *Must not begin or carry out any project on uncultivated land or semi-natural areas which affects an area of 2 or more ha, unless you have the permission from NE*; GAEC 6 - SSSI *Must not intentionally destroy or damage any of the SSSI's special interest features, or disturb any fauna that are a special interest feature. This rule can apply to actions that take place outside the SSSI itself but which have the same consequences.*		General protection of habitats with reduced/zero inputs, lack of ploughing or cutting (in some cases) allowing the natural function of water and soil.
Retention of terraces	CZ	included in the list of landscape features	N.A.	N.A.
	EL	Terrace, stone walls, dykes and other land supporting structures should not be destroyed.	N.A.	N.A.
	FR	Not implemented	N.A.	N.A.
	UK	Not implemented	N.A.	N.A.
	DE	Ban on the removal of terraces. Terraces subject to the removal ban are man-made linear structures in the agricultural landscape which are intended to reduce the gradient of farmland.	N.A.	N.A.
	RO	Existing terraces at 1 January 2007 will be maintained on agricultural land	Low impact on biodiversity.	High impact related to soil management because terraces are imposing ploughing along curve lines. Also, terraces have an effect on reducing soil erosion.
Prohibition on grubbing up olive trees and maintenance of	CZ	N.A.	N.A.	N.A.
	EL	The farmers should maintain orchards including vines and olive groves in good vegetative condition. There shouldn't be any unwanted plants older than 1 year.	N.A.	N.A.

olive groves and vines59	FR	It is forbidden to grub up olive trees. Derogations: where grubbing up is necessary to comply with the density rules set out in the specifications of the registered designations of origin or for health reasons accepted by the Regional Services for the Protection of Vegetation of the Ministry of Agriculture and Fisheries. -the trees should be maintained by reducing their foliage (size) to regularly eliminate old wood and promote bearing fruit and harvesting; - the soil should be maintained before 30 June either through cultivation or through mowing or grazing. The presence of scrub is prohibited.	The local standards adopted contribute to maintaining the topographical features, particularly hedges.	
	UK	N.A.	N.A.	N.A.
	DE	N.A.	N.A.	N.A.
	RO	N.A.	N.A.	N.A.
Standards for crop rotations	FR	Farmers must plant at least three crops, each of which covering 5% or more of the cultivated soil. In order to encourage diversification, it is accepted that the smallest of the three crops (in terms of area) will only account for 3% at least of the soil cultivated. This 3% ceiling may be reached by adding the third crop and all the other crops whose area is less. Farmers who plant at least 10% with leguminous vegetables or temporary grassland must plant two crops, one of which is a leguminous vegetable accounting for at least 10% of the soil cultivated OR two crops, one of which is temporary grassland accounting for at least 10% of the soil cultivated. If one leguminous vegetable or temporary grassland is the biggest crop, the lower limit is 3% for the second crop including the possibility of accumulating several diversification crops. Farmers who do not comply with any of the above rules are obliged to maintain a winter cover or to manage the crop residues by grinding.		Erosion, nitrate leaching.

[59] Collation of the GAEC standards "PROHIBITION ON GRUBBING UP OLIVE TREES" and “MAINTENANCE OF OLIVE GROVES AND VINES IN GOOD VEGETATIVE CONDITION".

	EL	In parcels with arable crops the farmers should apply crop rotation under one of the two scenarios: 1. 20% of the arable land of the holding should be cultivated each year with winter leguminous crops. In the parcels which are cultivated leguminous crops as the main cultivation there is no need for rotation, OR 2. 3 different crops should be cultivated in the holding. If the farmer presents a soil analysis proving the soil contains more than 3% organic matter, there is no need for crop rotation.	N.A.	N.A.
	UK*	GAEC 1 Soil Protection Review	N.A.	N.A.
	DE	Crop rotation must be organised and/or supplemented by other measures such that the organic matter in the soil is maintained.	N.A.	N.A.

* see GAEC on minimum soil cover

12 ANNEX 5 - ANTICIPATED EAFRD EXPENDITURE 2007-2013

Annex Table 11: Anticipated EAFRD expenditure by Member State and actual EAFRD spending by December 2010

MEMBER STATE	Anticipated Expenditure 2007-2013			Actual EAFRD expenditure (Dec 2010)	
	Total EAFRD	Total public	% of the total public	Actual EAFRD	% of the total EAFRD
Austria	4,026	8,019	50%	2,090	52%
Belgium	487	1,268	38%	247	51%
Bulgaria	2,642	3,279	81%	492	19%
Cyprus	165	329	50%	44	26%
Czech Republic	2,858	3,670	78%	1,125	39%
Denmark	578	1,021	57%	201	35%
Estonia	724	935	77%	226	31%
Finland	2,155	6,826	32%	986	46%
France	7,584	13,582	56%	3,095	41%
Germany	9,080	14,579	62%	3,568	39%
Greece	3,906	5,298	74%	1,132	29%
Hungary	3,860	5,257	73%	1,205	31%
Ireland	2,495	4,509	55%	1,425	57%
Italy	8,986	17,643	51%	2,068	23%
Latvia	1,054	1,384	76%	363	34%
Lithuania	1,766	2,287	77%	644	36%
Luxembourg	95	393	24%	53	56%
Malta	78	102	76%	21	27%
Netherlands	593	1,121	53%	169	29%
Poland	13,399	17,417	77%	3,820	29%
Portugal	4,059	5,144	79%	1,135	28%
Romania	8,124	10,097	80%	1,436	18%
Slovakia	1,997	2,597	77%	909	45%
Slovenia	916	1,177	78%	370	40%
Spain	8,053	14,776	55%	2,258	28%
Sweden	1,953	4,041	48%	827	42%
UK	4,612	8,149	57%	1,522	33%
EU 12	37,582	48,531	77%	10,655	28%
EU 15	58,662	106,371	55%	20,776	35%
EU 27	96,244	154,902	62%	31,431	33%

Source: IEEP own calculations based on DG Agriculture data updated in December 2010. .
Notes: data in Millions of Euros; FR and PT data include overseas territories.

Annex Table 12: Anticipated EAFRD expenditure on the selected measures in EU-27 in 2007-2013

Focus on biodiversity	RD MEASURES	PUBLIC FUNDING FOR MEASURE	% OF TOTAL PUBLIC	EAFRD FOR MEASURE	% OF TOTAL EAFRD	NATIONAL CO-FINANCING PER MEASURE
Direct focus	Agri-Environment (214)	37,630	24.3%	22,231	23.1%	15,399
	Non-Productive investments (216)	1,093	0.7%	591	0.6%	502
	TOTAL	**38,723**	**25%**	**22,822**	**23.7%**	**15,901**
Partial focus	Advice and training measures (111, 114, 115)	2,685	1.7%	1,622	1.7%	1,063
	Farm modernisation (121)	17,312	11.2%	10,667	11.1%	6,645
	LFA payments (211, 212)	22,752	14.7%	13,482	14.0%	9,270
	Natura 2000 (213)	777	0.5%	477	0.5%	301
	First afforestation of agricultural land (221)	3,403	2.2%	2,295	2.4%	1,108
	First establishment of agro-forestry systems on agricultural land (222)	25	0.02%	16	0.02%	8
	Conservation and upgrading of the rural heritage (323)	2,193	1.4%	1,315	1.4%	879
	Training and Information (331)	261	0.2%	148	1.5%	113
No direct focus	Adding value to agricultural products (123)	9,048	5.8%	5,647	5.9%	3,400
	Infrastructure development (125)	8,074	5.2%	5,129	5.3%	2,945
	Improvement of the economic value of forests (122)	992	0.6%	654	0.7%	338

Source: IEEP own calculations based on DG Agriculture data updated in March 2011.
Notes: data in Millions of Euros

13 ANNEX 6 - SUMMARY OF THE MAIN BIODIVERSITY BENEFITS OF SET-ASIDE IN THE EU

Annex Table 13: Summary of the main biodiversity benefits of set-aside in the EU

Environmental Indicator	Set-aside (SA) attributes benefiting environment (type, location and management)	Scientific evidence
Biodiversity:		
Plants	Naturally regenerated rotational and non-rotational SA increased species diversity and wildlife benefit compared to arable crops. Species diversity of naturally regenerated, non-rotational SA increases over time, becoming typical of grassland. Botanical value of sown cover depends on seed mix, management and natural conditions. Strips buffer hedgerow plants and other habitats from spray/fertiliser drift. Non-selective herbicide used for weed control kills all plant life and reduces environmental value of SA.	• Boatman *et al*, 2011 • Firbank and Wilson, 1995 • McCoy *et al*, 2001 • Henderson and Evans, 1999 • Henderson *et al*, 2000 • Bracken and Bolger, 2006 • Firbank *et al*, 2003 • Sotherton, 1998 • Curry, 2008 • Kovács-Hostyánszki *et al*, 2011
Birds	Naturally regenerated SA provides winter food for birds such as Skylark and Linnet. Densities are higher than on conventional crops. Rotational naturally regenerated SA provides important breeding habitat for a range of bird species. More species breed there than on arable land. Longer term non-rotational SA is favoured by different species such as Little Bustard which are characteristic of meadows. Field margin strips benefit some species such as Yellowhammer but are not used by species such as Skylark and Lapwing which prefer whole field SA. Food sources for birds can be enhanced by sowing wild bird seed mixes.	• NABU, 2008 • Herzon *et al*, 2011 • Wretenberg *et al*, 2007 • LPO, 2007 • Henderson *et al*, 2000 • Van Buskirk and Willi, 2004 • Smith *et al*, 2010 • Hyvönen and Huusela-Veistola, 2011 • Cumulus Consultants, 2007 • Vickery *et al*, 2009
Mammals	Mammals benefit much more from non-rotational SA where the habitat is more representative of grassland. Voles and mice benefit from uncut, non-rotational SA whilst they provide food for predators higher up the food chain eg birds of prey.	• Vaughan *et al*, 2003 • Macdonald *et al*, 2007 • Tattersall *et al*, 1998 • Tattersall *et al*, 1999 • Grice *et al*, 2007
Invertebrates	SA supports more invertebrate species than cropped land and invertebrate diversity and density increases with SA age. Spiders use SA as a winter refuge habitat. Non-rotational SA appears to benefit large populations of butterflies which feed on pollen and nectar from plants growing on SA. Grass margins are significantly beneficial to overall butterfly abundance with margins with wildflowers supporting greater butterfly abundance and species richness.	• Kennedy, 1992 • Moreby and Aebischer, 1992 • Poulsen *et al*, 1998 • Alanen *et al*, 2011 • NABU, 2008 • Cumulus Consultants, 2007 • Tscharntke *et al*, 2011
Reduction of external pressures on biodiversity	SA reduces input levels of pesticides and fertilisers. Non rotational, long-term SA almost completely removed nitrate leaching on non-manured soils and is associated with a reduced level of total P loss (15-20%), through reduced detachment, which increases as SA becomes long-term (up to 50% reduction). Large areas of SA in nutrient sensitive water catchments appear to yield significant benefits. Permanent buffer strips alongside water courses reduce nutrient run-off and prevent pesticide drift.	• EEA, 2005 • Cumulus Consultants, 2007 • University of Cambridge, 2006 • IGER, 2005

Source: adapted from IEEP (2008)

14 ANNEX 7 – OVERVIEW OF ELIGIBILITY RULES FOR DIRECT PAYMENTS

Annex Table 14: Overview of eligibility rules for Pillar 1 direct payments

Eligible land[1]	SAPS	SPS
Comprises	Arable land, permanent grassland, permanent crops, kitchen garden	Arable land, permanent pasture and permanent crops
Definition	Utilised agricultural area[2,3]	Used for production or kept in GAEC when other agricultural activities cease[4]
Additional clause	Part of utilised agricultural area which was maintained in good agricultural condition (GAC) in 2003 or in Bulgaria and Romania, maintained in GAC every year[5]	
Minimum size per holding/minimum requirements	0.3 ha[6] or 100 euros of direct payment[7]	1 ha or 100 euros of direct payment[7]
Land use	Permanent pasture limits	Permanent pasture limits

Source : Council Regulation 73/2009

Notes :

1. Eligible land is termed 'eligible hectare' under SPS and 'eligible area' under SAPS (Articles 34(2)(a) and 124(1) and (2) of Regulation 73/2009.
2. Article 124(1) and (2) of Regulation 73/2009.
3. Although GAEC is not explicitly mentioned in the definition of 'eligible area' under SAPS. In contrast to the definition under SPS, it is required under Article 6 of Regulation 73/2009 for both payment schemes.
4. The wording given in the Regulation 'Any agricultural area of the holding that is used for an agricultural activity or predominantly used for agricultural activities' Article 34(2)(a) of Regulation 73/2009. 'Agricultural activity' is defined as the production, rearing or growing of agricultural products including harvesting, milking, breeding animals and keeping animals for farming purposes, or maintaining the land in good agricultural and environmental condition as established in Article 6 of the regulation (Article 2 (c)).
5. Article 124(1) and (2) of Regulation (73/2009).
6. Minimum size in SAPS can be adapted to 1 ha by the Member State.
7. MS may adapt these thresholds within fixed limits, see art 28 of Reg. 73/2009.