REFLECTING ENVIRONMENTAL LAND USE NEEDS INTO EU POLICY: PRESERVING AND ENHANCING THE ENVIRONMENTAL BENEFITS OF "LAND SERVICES": SOIL SEALING, BIODIVERSITY CORRIDORS, INTENSIFICATION / MARGINALISATION OF LAND USE AND PERMANENT GRASSLAND

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EXECUTIVE SUMMARY

Background and objectives of the study

There is increasing global awareness, through studies such as the *Millennium Ecosystem Assessment* and the initiative on *The Economics of Ecosystems and Biodiversity* (MA, 2005; TEEB, 2008, 2009), of the important benefits that ecosystem services provide to humankind. This has also been recognised in Europe, where there is a growing political ambition to maintain and where necessary restore or enhance ecosystem services. This ambition is reflected in the EU biodiversity strategy (COM (2006) 216) and is reinforced in the proposals for a new EU post-2010 biodiversity target, which explicitly refer to ecosystem services as well as biodiversity (COM (2010) 4 final[1]).

This study was commissioned by the European Commission to contribute to the delivery of four key ecosystem services, namely the provision of food, water (in terms of quality and quality), soil carbon (in particular soil organic matter) and biodiversity[2]. These are hereafter referred to as the land services. Its overall purpose was to develop an approach at the EU level for the protection of these land services, against the background of changing land use and climate change. In particular, it aimed to establish recent trends and likely future changes in land use in the EU up to 2030, and how these may impact on the land services through the following four key pressures:

- **Soil sealing** (i.e. making the upper layer of the soil impermeable through the use of asphalt, concrete or similar materials that prevent or severely restrict the exchange of water and gases between the soil and the atmosphere).
- **Habitat fragmentation,** including the loss of biodiversity corridors (i.e. land areas and associated habitats that functionally connect patches of suitable habitat for plants and animals).
- **Land intensification and marginalisation** (i.e. intensification being an increase in agricultural inputs for the purpose of increasing productivity; marginalisation being defined in this study as the reverse of intensification, which leads to extensification and in some cases agricultural abandonment[3]).

[1] http://ec.europa.eu/environment/nature/biodiversity/policy/pdf/communication_2010_0004.pdf

[2] In itself biodiversity is not a service, but underpins supporting, regulatory, provisioning and cultural services. However, it was treated as a service in this study.

[3] Strictly speaking marginalisation is a process driven by a combination of social, economic, political and environmental factors, by which the management of certain areas of farmland cease to be viable

- **The loss of permanent grassland,** which often results from land intensification in the sense of arable conversion or reseeding of permanent grassland or abandonment of agriculture (with permanent grassland being defined in this study as all farmland under grass or herbaceous forage that has not been in an arable rotation for 5 years or more[4]).

The final objective of the project was to draw together assessments of likely land use changes and resulting pressures in Europe in the coming years to provide an integrated evaluation of potential impacts on the four land services. This has led to a set of recommendations (that take into account existing legislation and other policy instruments) that provide an outline blueprint of how land services might best be protected from the potential future threats identified in this study.

The following sections summarise this study's results relating to:

- observed and projected land use changes in the EU;
- the implications of these projected changes in terms of soil sealing and its impacts on land services, and habitat fragmentation and its impacts on biodiversity;
- assessments of the effectiveness of biodiversity corridor initiatives that aim to mitigate the impacts of fragmentation;
- assessments of policy instruments that may reduce the impacts of intensification/ marginalisation (including the loss of permanent grassland) on land services, and overall likely impacts of intensification/ marginalisation on land services; and
- key recommendations for maintaining and restoring land services.

Analysis of land cover trends and projections of land use for the next 25 years

The first stage of this study is an analysis of land cover trends in the EU (using HISLU60 and Pan-European Land Cover Mosaic datasets) over two time periods: 1960-1990 and 1990-2000. This revealed that there were dramatic overall changes in land cover in the EU-27 between 1960 and 1990, which led in particular to substantial losses of grassland (from 19% to 7% cover) and increases in forest cover (from 25% to 33% cover), and a smaller but significant increase in arable land (from 38% to 40% cover). Forest expansion was associated with significant losses of grasslands in many parts of Europe, including central Europe, parts of France, the UK and Portugal, and northern Spain.

Over the following 10 years, the rates of change in land cover declined considerably such that there were only relatively small declines in arable land and grassland, and virtually no change in other land cover types other than urban areas. It is difficult to quantify pre-1990 urban land cover accurately but the available data suggest that there was considerable urban growth from 1960 to 1990, which continued after 1990

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under existing land use and socio-economic structures. This can in fact lead to intensification or extensification and abandonment.

[4] In accordance with the definition of 'permanent pasture' in EU Regulation 793/2009 on direct CAP support for farmers. But permanent grassland can in fact be defined in many ways, with ecological definitions typically referring to much older grasslands.

but at a slower rate. Loss of agricultural land to urban development has been most prevalent in north-western Europe but it has only affected a small proportion of land.

Superimposed on the broad changes in land cover were changes in agricultural land use in terms of intensification and abandonment. These changes are more difficult to measure and map, and therefore past trends in these processes are uncertain. However, available information suggests that over the last few decades abandonment has been relatively widespread in areas with extensive production and small farms, especially in mountainous regions and/or on poor soils. Abandonment seems to have been most common in the Alps, Pyrenees, Portugal, central Spain, Sardinia, the former GDR, the Baltic States and parts of eastern Europe. Abandonment also occurred sporadically and at various times in parts of north-west Europe including Ireland, Denmark and the Netherlands, but was very often localised and relatively small-scale.

Intensification indicators suggest that over the 1990-2000 period, the main areas of intensification were in Ireland, Spain and parts of North Western Europe, and during the later part of the decade in the former GDR, Hungary, and the Baltic States (following earlier extensification and widespread abandonment of agriculture).

Looking to the future, as a result of expected trends in land use drivers (see below) and policy responses, it is likely that there will be major changes in Europe over the coming few decades, particularly in the spatial patterns of agricultural land use and intensity of agricultural practices. This study therefore sought to identify potential land uses changes up to 2030 in the EU-27 through spatially-specific land use modelling (using a chain consisting of GTAP, IMAGE and CLUE models). The main external driving factors specified as input to the models were demographic changes, overall economic development (GDP), technological change and policy measures. These factors were set according to the chosen reference scenario of "B1 global cooperation" based on the IPCC Special Report on Emission Scenarios (IPCC, 2000)[5]. It is therefore important to note that the projections from this study are not predictions of what is likely, but what may happen according to one set of plausible assumptions.

According to the modelled projections of land use change the main areas of future intensification in the EU up to 2030 are expected to occur in the EU-12 Member States, especially the Baltic States, because there is considerable scope for further investment, restructuring and technological improvements in the agriculture sector in the region. There are large areas of High Nature Value[6] (HNV) farmland in these countries, but it appears likely that these will be more at risk of abandonment than intensification (although this is a possibility following restructuring of farm holdings).

[5] The B1 scenario has been further developed for Europe by Westhoek *et al* (2006) and combines a global orientation with a preference for social, environmental and broadly defined economic goals (i.e. more than simple profit). Governments are considered to be actively regulating and ambitiously pursuing goals related to, for example, equity, environmental sustainability and biodiversity.

[6] HNV farmland includes arable farmland, grazing land and permanent crops that support important biodiversity, typically because of their low intensity, presence of semi-natural vegetation and habitat diversity; they are often an integral part of extensive livestock farming systems.

Losses of permanent grassland as a result of both intensification and abandonment are projected to be widespread across the EU, with particularly large declines predicted in Portugal, Greece, Spain and Estonia.

It was not considered appropriate to quantify abandonment given the high levels of uncertainty in assumptions and the degree to which land owner decisions will actually be directly linked to economic drivers. Nevertheless, from an inspection of the maps of projected land use change, under the B1 scenario, it is obvious that abandonment will be widespread, particularly in Spain and Portugal, parts of Finland and Sweden, highland areas of France, Italy, central Europe, Romania, Bulgaria and the UK, and parts of Greece. This is consistent with previous studies, which indicated that the regions most susceptible to marginalisation are those where extensive farming and small-scale farming is predominant. It is also of concern that HNV farmland areas (which are important for biodiversity) will be particularly affected by land abandonment, according to the detailed analysis carried out in this study. The incremental projected land use changes indicate that by 2030, 9.0% of non-irrigated arable land within HNV areas may become (semi-) natural vegetation and 10.9% may turn into recently abandoned arable land. The projected abandonment trend for HNV pasture is even greater, with 20.4% developing into recently abandoned pasture, and 7.7% developing further into semi- natural vegetation[7]. Of existing semi-natural vegetation, 17.3% is projected to develop into forest.

Soil sealing: trends, projections, policy instruments and likely impacts on land services

Soil sealing was observed to result in a loss of suitable land for arable cropping and permanent grassland amounting to 1% of the land area per annum in EU countries in the period from 1990 to 2000. Similar overall losses from soil sealing are projected for 2000-2030 under the B1 reference scenario. The largest projected impacts on the loss of land capable of food production are likely to occur in the Netherlands (3.0% loss of arable crop area and 3.2% loss of permanent grassland) and in the UK (1.5% losses of both arable land and permanent grassland). This is a result of the relatively high projected growth rate of built-up areas, and the high percentage of land suitable for food production in the areas likely to be converted. Although the projected loss of land suitable for agriculture is relatively small compared to the total stock of agricultural land in the EU27, the loss may nevertheless be significant in terms of net primary productivity.

Averaged over the EU, the effective soil water storage capacity decreased as a result of soil sealing by 0.5% in the period 1990-2000, and is projected to decrease by a further 0.8% between 2000 and 2030.

The projections suggest that the impacts of soil sealing on biodiversity will be generally relatively small, due to the low biodiversity value of areas that are most typically affected by soil sealing.

[7] The model is based on CORINE categories and therefore some HNV pastures are included in the projections for pasture and others for semi-natural habitats.

Due to the high variability of soil organic carbon in urban areas and lack of sufficient studies it is difficult to make generalizations on the likely impacts of soil sealing on carbon stocks. However, it is estimated that soil sealing in the period 1990-2000 resulted in a loss of 4.6 Mton C in 23 EU countries, which is equivalent to an annual emission of 1.7 Mton CO_2. The highest losses occurred in northwest Europe (i.e. the Netherlands and Germany). For the period 2000-2030 soil organic carbon losses due to soil sealing are projected to decline substantially to an annual emission equivalent of 0.7 Mton CO_2.

Analysis of the effects of projections of land use change on habitat fragmentation and its subsequent impact on the provision of land services

The implications of this study's projections of land use change up to 2030 on habitat fragmentation were examined in the context of proposals for biodiversity corridors, using the spatial connectivity model LARCH. On the basis of maps of projected changes in land cover and of expected road networks and traffic densities, functional habitat networks were identified for generic species groups ('ecoprofiles') for forest habitats, wetland habitats and semi-natural habitats (other than wetlands and forests). However, the absence of high resolution and detailed spatial data on the distribution of detailed habitat types hampered the quantification of projected European scale habitat fragmentation impacts.

Nevertheless, despite the data limitations, it is clear that the combined effects of the projected land use changes and increases in road traffic densities will most probably have large negative impacts on the connectivity / corridor functions of important natural habitats in large parts of the EU, especially in areas with mixed landscapes, unless mitigated or compensated for through additional connectivity conservation actions. The countries where the impacts of fragmentation are likely to be greatest on species that depend on forest habitats are Latvia, Lithuania, Poland, the Czech Republic and Slovakia. Fragmentation of non-wetland semi-natural habitats is likely to be greatest in southern Europe (except Italy). Due to data constraints fragmentation impacts on species of wetland habitats could not be reliably assessed.

A visual analysis was carried out of the congruence between areas that are important for connecting existing functional habitat networks (as revealed by the LARCH model maps) and maps of national and regional plans for ecological networks. This suggested that there was mostly a broad match between plans and the important connectivity zones as indicated by the LARCH model. However, the plans and available habitat maps are too general to assess the potential adequacy of the proposed ecological networks. Moreover, it is difficult to assess the actual contribution that the proposed ecological networks can be expected to make to maintaining and restoring functional connectivity, because (as discussed below) few ecological network initiatives have been adequately implemented to date. Nevertheless it is clear that current connectivity conservation measures in most EU Member States are insufficient to overcome existing and expected fragmentation impacts. Further action is also undoubtedly required to reduce the underlying drivers of fragmentation, in particular the growth of transport infrastructure and other causes of habitat losses in the wider environment.

The effects of policy instruments and ecological network initiatives on habitat fragmentation

The maintenance and restoration of biodiversity corridors, usually as part of an ecological network, has been long proposed as an approach to tackling fragmentation. But despite the development of numerous proposals for ecological networks, few appear to have been adequately implemented and there is little evidence that the corridor components of these networks have provided significant biodiversity conservation benefits. This study therefore examined the following nine ecological network case studies (through a questionnaire survey and workshop with practitioners): Cheshire (UK), the Czech Republic, Estonia, Schleswig-Holstein (Germany), Flanders (Belgium), Finland, the Netherlands, and Lithuania. These were selected because they are established initiatives that reflect a range of approaches and degrees of successful implementation. The aim was to assess their achievements and identify factors that helped or hindered them.

The review highlighted the importance of developing and agreeing clear biodiversity and broader objectives for biodiversity corridors and ecological networks. To achieve ecological goals, it is vital that each corridor is designed with the needs of a particular species or sets of species in mind, and is based on principles of sound scientific evidence. The design should also be very clear about why connectivity is necessary (e.g. for facilitating migration or linking small isolated populations), and focus on addressing these needs. It should also be remembered that ecological corridors are but one approach to tackling fragmentation. For example, there is good evidence that fragmentation impacts can often be reliably addressed by firstly protecting, increasing and enhancing important core areas of habitat.

The case studies also revealed that most effort has often been put into the design of the proposed networks rather than their implementation, with the result that they exist more on paper than in practice. This is mainly because most network proponents have limited powers and/or capacity to protect, manage and restore habitats. In many cases network maps have been incorporated into spatial plans, and where biodiversity benefits have occurred these have mostly been through the legal protection of existing habitats in core areas and biodiversity corridors. Legal protection of the network components is therefore very important, and should include measures ranging from strict legal protection for the most important habitats and features to indicative planning guidance maps for corridors of lesser or substitutable importance. However, in practice effective protection rarely extends beyond existing protected areas. The implementation of ecological networks, and especially the maintenance and restoration of corridor components, is therefore highly dependent on the support of landowners and available funding, but this is often hampered by inadequate or ill-timed consultation with stakeholders.

A related problem is that some network initiatives are focussed on relatively narrow ecological objectives, and therefore lack wide support from the public and other stakeholders. Network proponents should therefore look for opportunities to create local partnerships at an early stage, to identify and work towards mutually beneficial goals and multi-functional uses of areas where these are compatible with biodiversity conservation objectives (for example recreation or water protection). Achievable aims and a clear vision should then be agreed, to guide the design of the network and to help communicate the network's potential benefits.

Network proponents also need to consider the technical capacity and resources required to implement plans on the ground (such as land purchase or agreements with land owners to restore and manage habitats). Securing adequate funding and targeting it at the most cost-effective actions in core areas and biodiversity corridors is therefore of prime importance.

This study also found that there is very little monitoring and evaluation of the practical implementation of ecological network actions and their actual ecological outcomes (e.g. in terms of benefits to populations of particular species). This is considered to be a significant weakness, because monitoring and evaluating the implementation of both policy interventions and ecological impacts facilitates adaptive management and provides an evidence-base to support further actions and network proposals.

Drivers and policies that influence intensification, marginalisation and the loss of permanent grassland

An examination of the drivers of agricultural change and policy interventions that potentially affect the delivery of the land services was carried out to establish whether there is a need to review EU policy design and implementation. This highlighted that European farmers are increasingly exposed to a range of influences including a rising global demand for agricultural products and bioenergy, technological changes, trade liberalisation and climate change. These influences are linked to significant recent reforms of the CAP, likely to be continued in 2013. At the moment there is period of consolidation and adjustment, as farmers adapt to the introduction of decoupled Pillar 1 payments (i.e. no longer linked to production) and Member States address the 'new challenges' that were agreed in the CAP health check of 2008.

Existing trends of specialisation and the exploitation of economies of scale are expected to continue, as production moves towards the most competitive (and climatically favourable) parts of Europe, with intensification likely in parts of the EU-12. Arable production is expected to increase, but profitability of the beef, dairy, sheep and goat sectors will probably decline, with the result that production becomes concentrated in fewer, larger units on fertile land, while the numbers of grazing livestock decline elsewhere. There will be some partial or complete abandonment of marginal grassland (although as described above, the extent of this is uncertain). On these assumptions, and given the large number of older farmers who will retire over the next decade or so, many HNV grazing systems will not survive, and those that do will probably require significant long-term public funding.

It is clear that the CAP framework already has a number of policy instruments that could be used to alleviate the negative impacts of intensification and marginalisation (and associated losses of permanent grassland), in particular, GAEC[8] cross-compliance requirements for receipt of payments, and agri-environment schemes and other Pillar 2 environmental measures. Requirements under the Water Framework Directive may also lead to new actions that will help to address the impacts of

[8] Good Agricultural and Environmental Condition, as defined by Member States within the framework in Annex III of Regulation 73/2009

intensification. However, although the cross-compliance requirements on conversion of permanent grassland should limit total losses at the Member State level nationally, they offer no specific protection for habitats of high biodiversity importance (including old semi-natural grasslands). Furthermore, the leverage exerted by cross-compliance requirements could gradually weaken in the EU-15 Member States as assuming that Pillar 1 payment rates per hectare decline after 2013. Another challenge will be the rising cost of Pillar 2 environmental support, as a result of the relative profitability of arable and intensive dairy farms and the marginalisation of small, low-intensity livestock and permanent cropping farms. Without significant changes in budget allocations this could reduce the scope, coverage and effectiveness of agri-environment schemes.

Assessment of impacts of intensification / marginalisation and loss of permanent grassland on land services

It is evident from this study that the impacts of land use drivers and policies is very context-dependent, therefore leading to intensification in one place and to structural or land use change in another, or to loss of grassland on some farms but improved biodiversity management elsewhere. These variations make it difficult to draw EU wide conclusions on impacts of the drivers on land services, which has implications for both the design and implementation of policies. Furthermore, there are few EU datasets that are sufficiently consistent and complete to enable quantitative assessments of impacts on land services. In particular it is not possible to quantify overall impacts on food production, as expected increases from intensification in some parts of the EU may be offset to some extent by the expected decline in total agricultural area. There may also be some negative impacts on food production as a result of climate change and ongoing soil degradation and erosion (which may be exacerbated by climate change). Nevertheless, there is little indication that there will be potentially significant declines in overall production that could contribute to food shortages or food security issues in the EU.

There is, however, good evidence that the projected intensification of conventional agricultural systems will contribute to further losses of soil carbon, and reductions in soil water retention and water quality. This may be mitigated to some extent by improved farming practices and technology, and extensification and abandonment of farming in some areas, especially where these coincide with erosion prone soils. It is not possible to quantify these changes or establish the net impact resulting from intensification in some areas and marginalisation in others.

There is also little doubt that this study's projected levels of intensification/marginalisation and associated losses of permanent grassland would have significantly detrimental impacts on biodiversity. These impacts are likely to be most significant in central and eastern Europe, because agricultural production in these areas is most likely to be intensified or abandoned, and these areas hold a high proportion of remaining HNV habitats and associated species of conservation importance in the EU. In some situations abandonment could provide some biodiversity benefits, particularly if combined with strategic and proactive habitats restoration measures, but overall, abandonment is expected to be an ongoing significant threat to biodiversity in the EU.

Assessment of overall impacts of pressures on land services

The final analytical component of the study attempted to provide an overall assessment of the combined impacts of each of the considered pressures on the four land services. Due to substantial data gaps and difficulties with matching datasets it was not possible to provide a quantitative assessment of combined impacts. However, semi-quantitative judgements on overall impacts were made by drawing on and assimilating all the results of this study.

It was not possible to assess and quantify in a meaningful way the likely overall net change in food production in the EU as a result of the projected changes in agricultural intensification and land use (let alone the impacts of climate change and other indirect influences on food production). Nevertheless, there is no clear evidence that the EU will face a risk of undersupply of food. There may be some concern in this respect over the projected large-scale abandonment of agricultural land, but this will mainly affect extensive grazing systems and therefore meat and diary production losses will be relatively low. Indeed, the market economics that drive marginalisation suggests that production losses from these systems will be compensated by intensification elsewhere in the EU and/or displacement of production outside the EU where this is more cost-effective.

It is evident that the four land-use related pressures considered in this study will continue to have significant impacts on biodiversity in the EU. In particular, many of the most valuable remaining areas of semi-natural habitat are likely to be threatened by agricultural intensification or abandonment. Such impacts will be especially severe in parts of eastern Europe where intensification will probably predominate in areas that are favourable for agriculture, whilst abandonment will be commonplace in the extensive areas of HNV farmland within the region. Abandonment will also be a significant threat to HNV farmland habitats in southern and south-eastern Europe. Furthermore, these pressures will also interact with each other. Fragmentation resulting from urbanisation and infrastructure developments (which also causes soil sealing) will exacerbate expected losses and fragmentation of patches of semi-natural habitat as a result of intensification and abandonment. The withdrawal of extensive grazing as a result of abandonment is a particular concern, because of the potential loss of valuable semi-natural grasslands to self-regenerating scrub and forest. Although it is expected that some new semi-natural habitats will develop (such as woodland), without strategic placement and proactive restoration management, most will be of low biodiversity value, at least for many decades. All of the pressures on biodiversity will be further exacerbated by climate change, which will make habitats and species more susceptible to the impacts of habitat loss, degradation and fragmentation.

In conclusion, there is little doubt that terrestrial biodiversity will continue to decline in the EU as a result of these pressures, and therefore any potential post-2010 target of halting biodiversity loss, or even reducing the rate of loss, will be very difficult to achieve without further urgent, widespread and more effective actions that effectively address the key pressures on biodiversity.

There is a body of existing evidence to indicate that soil sealing and agricultural intensification (including the conversion of permanent pasture to more intensive temporary grasslands) will have significantly detrimental impacts on water quality

and (to a lesser extent) water retention and soil carbon levels. Fragmentation may also have small detrimental impacts on these services (e.g. by reducing interception of nutrient-rich runoff and spray drift). In contrast, environmentally sensitive farming practices, extensification and abandonment can reverse these impacts. Indeed, there is considerable scope for increasing the provision of clean water and carbon storage and sequestration through better strategic planning of land uses and improvements in land use practices. Moreover, such actions could provide multiple "wins" including contributing to carbon emission reduction targets, water resource provision and biodiversity conservation. And with the expected impacts of climate change, such actions will be increasingly important contributions to climate change adaptation.

Policy analysis and recommendations for measures to maintain and enhance land services

A number of policy recommendations are made that aim primarily to avoid further losses of the services provided by biodiversity, water and soil carbon, and secondly, to restore and enhance these services where feasible; whilst avoiding significant impacts on net food production capacity in the EU. They also aim to avoid the development of conflicting policy measures, and instead identify measures that have multiple and potentially synergistic benefits.

One of the main conclusions that can be drawn from this study is that the concept of "land services" (like "ecosystem services", of which it could be considered a component) is helpful in challenging compartmental modes of thinking. It draws attention to the importance of different forms of land management and the links between them and has value as an analytical tool. However, in operational policy terms the various elements inside the circle described by land services are rather disparate and straddle different policy fields. Therefore there seems to be limited scope for general policy responses. Instead it seems more appropriate to enhance awareness of the different dimensions of the challenge and direct action to a series of relatively specific and not necessarily related policy domains. Consequently, the development of a dedicated policy instrument for ecosystem services, such as a framework directive, does not seem appropriate.

Furthermore, it is evident that a relatively strong and comprehensive framework of environmental legislation and other instruments exist that can help to maintain and restore the provision of the land services. Consequently, most recommendations focus on improving the implementation of existing instruments. A few more ambitious policy proposals are made that relate to, for example, coordinated implementation of instruments to provide ecosystem services at a landscape or catchment scale, the strategic planning of land use and the allocation of budgets. These suggestions are made because their potential benefits for land services are considerable. But it is recognised that some are longer-term measures, requiring considerably more analysis to develop practical and politically feasible proposals, followed by full impact assessments.

Adequate funding is of critical importance to the effectiveness of many policy instruments and therefore some key broad recommendations relate to the EU budget. In particular it is recommended that:

- The Commission should review opportunities to improve the effectiveness and integration of the different elements of the EU budget that could be used to encourage and support the provision of land services where these services are not likely to be provided by the market.
- Sufficient budgetary resources should be secured for the CAP to deliver revised CAP priorities for the provision of environmental services (see below), allocated between Member States/ regions according to robust criteria appropriate to the CAP objectives.
- Consideration should be given to the establishment of a new EU biodiversity fund to address issues outside the scope of the CAP and CFP which are likely to be the principal source of EU funding for biodiversity beyond 2013.

Many of the sectoral policy recommendations relate to the CAP, as this is the main EU policy and funding instrument influencing land management practices in all Member States and hence the provision of the land services. A recent report for DG Agriculture noted that there is considerable unmet demand for environmental public goods that could be provided by agriculture and could be met by use of policies within the CAP policy framework. Some of the key CAP related actions considered necessary at EU and Member State level to maintain and restore the land services are:

- Refocus the CAP beyond 2013 to include a core objective of delivering ecosystem services on farmland that the market does not provide and ensure sufficient budgetary resources are secured to provide these services at the necessary levels.
- While cross-compliance remains a component of the CAP, keep farm-level requirements updated with relevant new EU environmental legislation (especially on soils), provide further guidance for Member States on GAEC implementation, and investigate the potential consequences and effects of "Environmental Priority Areas" as a cross-compliance requirement.
- Member States should provide better protection for species-rich permanent grassland from intensification or conversion to other uses (including use for biofuel production).
- Give higher priority to providing integrated packages of measures from both CAP Pillars to support HNV farming systems that are delivering land services, and provide guidance on this for Member States.
- Use CAP measures on a much larger scale to help intensive farming systems provide a basic level of land services and incentivise further provision.
- Improve geographical targeting of policy measures; encourage landscape scale delivery; intensify advisory and information services and tailor them to different farming systems and land services.
- Develop, adapt and implement common monitoring and evaluation programmes, and invest in data, to provide an evidence base for future policies on land services.

Of particular importance is the need to strengthen and better implement many existing biodiversity policy measures. Although biodiversity underpins the provision of ecosystem services this has not been sufficiently recognised to date, as a result many biodiversity conservation measures have been weakly, slowly or incompletely implemented. As a result, in part, the EU will fail to meet its 2010 target of halting the loss of biodiversity. It is therefore recommended that:

- The Commission should develop and agree with the Member States a strong and binding post-2010 target for halting and reversing biodiversity loss and related ecosystem services. But most importantly, whatever target is adopted, it will be necessary for all Member States and EU institutions to fully engage with and adhere to it to achieve the agreed objectives for biodiversity and associated ecosystem services.
- Greater encouragement should be given to the implementation of the EU Biodiversity Action Plan, through cross-sectoral actions by EU institutions and Member States.
- Member States should increase their efforts to establish management plans and measures for Natura 2000 sites (and other areas of high biodiversity importance) and to integrate these with the provision of other ecosystem services where there are mutual benefits. In particular, opportunities to facilitate ecosystem-based adaptation to climate change should be identified and acted on. This would help to justify increased targeting of Natura sites and biodiversity under existing funding instruments, in particular agri-environment schemes.
- The Commission should further encourage Member States to implement Article 10 of the Habitats Directive (and similar measures arriving from the provisions of the Birds Directive), through the establishment of national frameworks for assessing functional connectivity needs, and planning, integrating and implementing necessary actions.
- An explicit target of no-net biodiversity loss from projects and programmes should be included in a revised EU BAP, for individual projects and programmes. This could be underpinned by the establishment of a habitat banking policy framework that supports and regulates a habitat banking market involving developers who would purchase credits that would then be used by landowners or land managers to enhance or create land areas for biodiversity and ecosystem service gains.

Other key recommendations relate to a variety of sectoral actions and policies, including soil policy, the Water Framework Directive, environmental impact assessments and planning. With regard to these, some of the key actions put forward in the light of the challenges considered in the report are:

- Finalise a Soil Framework Directive that provides a mandate for action to address soils of concern but also protects valuable soil functions giving adequate weight to issues such as carbon sequestration, waste management and delivery of food/maintenance through agriculture.
- Review the Soil Thematic Strategy to examine successes since 2004/2005, taking account of the shifting policy priorities including more effectively covering the protection of soil functions in the light of issues arising in relation to agriculture, climate change and water resources.
- Ensure that during the implementation of the Water Framework Directive, river basin management plans thoroughly consider impacts on water availability (quantity) as well as quality and contribute to biodiversity and flood defence objectives.
- Provide policy guidance that encourages Member States to ensure that relevant biodiversity objectives are considered alongside Water Framework Directive and Flood Directive objectives in river basin management plans and flood risk management plans.

- Ensure the appropriate implementation of the Strategic Environmental Assessment and Environmental Impact Assessment Directives to improve their use as tools to assess the environmental impacts of plans, programmes and projects and help determine the most environmentally friendly approach to support spatial planning.

Finally, a potentially very beneficial cross-sectoral action would be to encourage and assist Member States to develop holistic visions of land use and policy instruments that support the strategic provision of land service requirements. Such strategic visions may then be combined with indicative strategic land use planning to encourage and support the optimal use of the land by spatially targeting the use of public funds (or other incentives) to deliver the most desired land services.

Looking ahead, it is worth considering whether land use and land services should figure more strongly in strategic thinking on the environment in the EU. For example, if there is a Seventh Environmental Action Programme this is a theme that could be explored more fully, in the same way that soil policy was given some prominence for the first time in the Sixth Environmental Action Programme.