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Consultation on the draft Soil Strategy for England

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Executive Summary

Our soils provide us with essential benefits including supporting the production of food and fibre, regulating temperatures by storing soil carbon and supporting natural habitats and biodiversity. We know from both history and scientific study that poor soil management can have severe consequences. Climate change will add to the pressures on our soil through likely temperature rises and severe climatic events as well as the expected demands of increased agricultural production. It is essential that our soils are therefore given adequate protection and risks are properly managed.

Through a new Soil Strategy, we seek to put in place a sound framework for policy making and delivery with the aim of ensuring the sustainable management of England's soils. The Strategy seeks to ensure that the work of Defra and its partners, from Local Authorities and Other Government Departments, to the Environment Agency and Natural England, as well as research bodies, is focused on the key issues that have been identified as affecting our soils. It also seeks to ensure that all these bodies work in a co-ordinated and consistent manner in order that we may achieve important outcomes.

The Strategy seeks to build on the success of Defra's First Soil Action Plan for England: 2004-2006 which put in place a clear framework and milestones. This led to some notable achievements such as the inclusion of soil standards in CAP cross-compliance and in agri-environment schemes.

The broad aim of the Strategy is to maximise the benefits that soils can bring to the economic and environmental well-being of today's generation and future generations. It relates to Defra's wider aim for us to live within our environmental means and reflects the key principles of the UK Sustainable Development Strategy, which include living within environmental limits.

The Strategy sets out the pressures on our soils today and the priority areas that we have identified on the basis of these pressures. It explains current policy measures which are in place to achieve sustainable soil management and then sets out in broad terms what it is that we hope to achieve and some initial steps we intend to undertake in the next few years. The proposed activity under the Strategy is also summarised at Annex B.

In developing this Strategy account has been taken of the EU Thematic Strategy for Soil Protection published by the European Commission in September 2006 and of the accompanying proposals for an EU Soil Framework Directive. EU Environment Ministers have not been able to agree on the regulatory approach proposed. However, our domestic Strategy sets out a sufficiently broad and high level set of objectives to allow future soils policy to be adapted in the event of a Directive being adopted in the future. The Vision and Objectives of the Strategy are entirely consistent with the broad direction of EU policy and do not therefore need to await decisions on specific legislative proposals.

Our vision is that England's soils will be protected and managed to optimise the varied functions (or ecosystem services) that they perform for society in keeping with the principles of sustainable development and in the context of climate change.

The draft Strategy has the following key objectives:

1. Ensure that measures for the protection of soil functions in respect of agricultural and forest soils are effective, targeted and proportionate, take into account future pressures including our changing climate and minimise adverse impacts on air, water, biodiversity and greenhouse gas emissions.
2. Reduce the rate of soil organic matter decline and protect habitats based on organic soils, such as peat bogs, to maintain our carbon stores (to mitigate climate change) and soil quality.
3. Establish the degree of risk from putting organic materials on soils and the consequences for human, animal and plant health and the environment, and seek to keep these risks at an acceptable level.
4. Ensure that, in accordance with the principle of sustainable development, the construction industry and planning authorities take account of the need to protect soil resources, and ensure soils in the built environment are able to fulfil as many as possible of their functions, especially storing, transporting and filtering water.

The following areas will be at the heart of the Soil Strategy:

Sustainable soil management in the agriculture and forestry sector

About 80% of England's soil is under agricultural or forestry management. We will continue to promote good soil management in this sector and ensure that measures are targeted and proportionate by evaluating the effectiveness of existing policy measures (for example, CAP cross-compliance and agri-environment schemes) before determining if further measures are required. Any new measures adopted will seek to ensure that improvements are made to soil structure, air and water quality. We will also seek to develop our understanding of the impacts of climate change on soil (both direct and through changes in cropping) and ensure that this is incorporated in any new policy measures we develop in order that we may adapt to climate change.

Halting the decline of soil carbon

Our soils contain huge amounts of carbon. There is evidence to suggest that carbon levels are declining in some agricultural, as well as upland organic (peat), soils and as a result carbon dioxide is being released into the atmosphere contributing to climate change. Moreover, it is predicted that climate change will lead to an increase in the loss of soil carbon. Over the next few years we need to improve our understanding of how and why soil carbon is declining and put in place policy responses and best practice measures to reduce the rate of soil organic matter decline. A new cross-cutting peat project focusing on the diverse functions of peat has been set up to ensure a co-ordinated approach in protecting and enhancing peat soils and related habitats.

Sustainable soil management in the built environment

Nearly 81% of the population of England live in urban areas which account for 7.48% of the land area. In those locations soils are subject to particular pressures, essentially because of the density of development. Smaller settlements outside urban areas may also be subject to these pressures. Development can have a significant impact on a range of functions including supporting biodiversity, filtering of water and the ability to absorb run-off. The floods in parts of England in summer 2007 showed what can happen in urban areas where drainage systems, including the natural drainage provided by soils, are overwhelmed.

Planning Policy Statements aim to protect soil functions in a range of ways, including recognising the value of agricultural soils, promoting Sustainable Urban Drainage Systems (SUDS) and through recognising the potential of, and encouraging, those land management practices that help secure carbon sinks including reservoirs such as soil. When regional and local plans are being put together, they are subject to Sustainability Appraisal. This includes the impact of spatial planning options on soil. Specific individual developments are also subject to Environmental Impact Assessment, which again includes looking at the impact on soils. We will provide further guidance on how to interpret the impact of development on soil functions to help planning authorities and developers apply these policies more consistently and effectively.

We will seek to ensure that the construction sector acts with due regard to soil functions and that it handles soils sustainably, reusing or recycling surplus soil where possible. We will complete the development of a Code of Practice for the sustainable use of soils on construction sites.

Protection of soil during the recycling of organic materials to land

The recycling of organic materials to land (for example, composts, industrial wastes and manures) can deliver improvements in soil quality and agricultural sustainability by increasing soil organic matter. However, there are risks that need to be managed during this procedure, such as contamination of the soil and diffuse nutrient pollution. We will seek to encourage such recycling while protecting soil functions and minimising possible risks to human health and the wider environment by establishing quality standards for organic materials being applied to land and determining the capacity of soils to accept these materials.

In order to ensure its capacity to deliver these priority areas, Defra will work on the following:

Evidence

Evidence is imperative to successful policy making and we must therefore ensure that there is appropriate evidence to evaluate and underpin the policies made to manage England's soils. Key areas for further investigation include the protection of soil carbon stores, the impacts of climate change on soil functions and the valuation of ecosystem services. Filling all of our evidence needs will require partnership and coordination with other research funders.

Stakeholders

In order to improve the sustainable management of England's soils, Defra will work with stakeholders and delivery agents. The Soil Action Plan Advisory Forum will become the Soil Strategy Advisory Forum. We plan to hold annual meetings, which will be open to stakeholders outside of the Advisory Forum, to provide an update on progress and future plans, with ad hoc meetings on specific topics as required.

Monitoring and evaluation

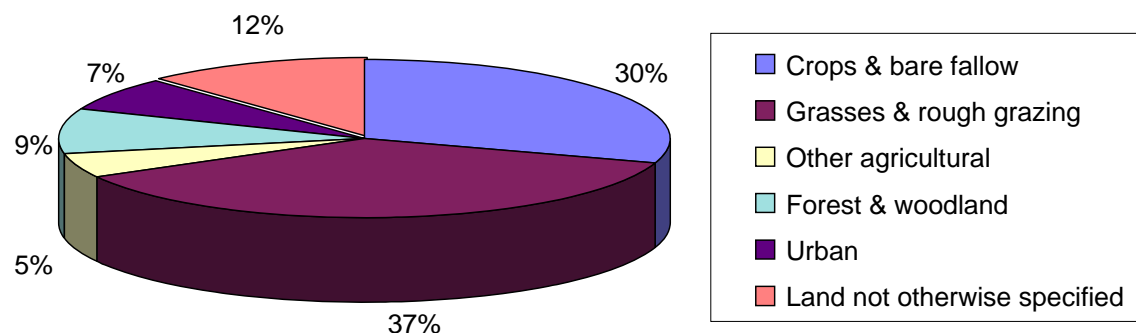
We will need to ensure that policy measures already in place are achieving their soil protection objectives without being overly burdensome on businesses. Programmes of soil monitoring will be carried out during the period 2007-2010 to help us understand the impacts of our work on improving the sustainable management of England's soils. Existing measures relating to agricultural soils, such as cross-compliance and Environmental Stewardship, are also subject to a review.

Achievement of these objectives requires joined up working between Defra, Other Government Departments, delivery and regulatory agencies, Local Government and stakeholders.

Chapter 1: Introduction: A Soil Strategy

- 1.1. Soil is a fundamental and ultimately finite natural resource. It is a key part of our natural capital. The way that we use soil and the impact of our activities on it will have important and far-reaching effects on the environment and the quality of our lives. Although policy measures have been introduced to protect our soils in recent years, soils are still being degraded with knock-on consequences for the wider environment including the release of greenhouse gases and hence climate change.
- 1.2. This draft Strategy sets out the pressures on our soils (see Chapter 2) and the vision and objectives (see Chapter 3) that underline this Strategy. In relation to identified priority areas, it sets out existing policy, seeking to bring together relevant policy in a single document, and setting out in broad terms how this needs to be modified and improved to achieve the outcomes sought.
- 1.3. This draft Strategy relates to all uses of soil and land (see Box 1 for distribution of land use). However, the focus of the Strategy is on agricultural land considering the proportion of total land area taken up by agriculture; soil in our urban environment which is under considerable pressure; and uncultivated land which holds a large store of carbon.

Box 1: Land use in England: 2005¹



Background

- 1.4. The programme of work set out in the First Soil Action Plan for England: 2004-2006² has come to a close. The Action Plan, published in May 2004, set out actions that Government and partners were committed to take in the short-term to improve the protection and management of soils.
- 1.5. The First Soil Action Plan has achieved most of what it was designed to do. Most notably it has raised the profile of soil within the land management community and amongst Government policy makers and delivery agents.

¹ <http://www.defra.gov.uk/environment/statistics/land/lduse.htm>

² <http://www.defra.gov.uk/environment/land/soil/pdf/soilactionplan.pdf>

Consideration of the impact on soil of policies and activities are beginning to be the norm for a large number of stakeholders, especially in the agricultural sector. This is a vast improvement over the situation even four years ago where soils were still being taken largely for granted.

1.6. Other significant developments include:

- the introduction of soil protection measures into the CAP single payment scheme (cross-compliance conditions);
- the inclusion of soil protection options in the Environmental Stewardship scheme;
- new planning policy focusing on delivering sustainable development through which the use of natural resources, including soil, are considered;
- the development of the 'soil-net' education resource; and
- the development of indicators of soil quality.

1.7. Some areas of the Action Plan have not progressed as quickly as anticipated, in particular those requiring a new evidence base to be established (e.g. on sustainable soil management within the construction sector). These actions are carried forward in this Strategy and include:

- work to assess sources and impacts of contamination of soil (see paragraph 4.24);
- the development of a Code of Practice for sustainable use of soils on construction sites (see paragraph 6.24);
- the development of alternative growing materials and soil conditioners to peat (see paragraph 7.9); and
- the development of a soil indicators monitoring scheme (see paragraph 8.11).

1.8. Progress against all of the actions in the Soil Action Plan and how they are being taken forward is set out on the Defra website³.

1.9. For all of our success so far there is still much to be done to improve the management of soils to deliver a wide range of benefits to society, as explained in Chapter 2. The Action Plan has provided us with a good foundation. We now need to determine what England's future Soil Policy should be and the purpose of this consultation is to seek your views on our proposed approach.

1.10. Following discussions with stakeholders it has been suggested that our future needs would be best served by a Strategy rather than a new Action Plan. A Strategy would allow us to set the future policy direction for England without the constraints of pre-agreeing all of the steps necessary to achieving this. It would allow us to work flexibly with partners to achieve the best solutions for soil, adapt to emerging priorities and provide a guide to stakeholders for how their own activities can contribute towards achieving our goals.

Why a Soil Strategy?

1.11. This Soil Strategy for England seeks to provide a vision for England's soils, to set down key objectives and to prioritise the work of Government and its

³ <http://www.defra.gov.uk/environment/land/soil/>

agencies. It explains the pressures on our soils and key conclusions of our research and sets out the measures already used to protect soil, for example, measures under the Water Framework Directive, CAP cross-compliance and agri-environment schemes.

- 1.12. It aims to provide a strategic framework for future domestic action to ensure that the Government and agencies work in a coordinated and effective way. It identifies key pressures and priority work areas. It aims to provide a broad framework through identifying these work areas rather than putting forward firm new proposals, though some key next steps for action by Defra and our partners within each of the priority work areas are included. In many cases these steps relate to work that is already in progress. The work planned for priority areas may lead to proposals for new or revised policies. These would be subject to impact assessment and consultation in the usual way before being implemented.
- 1.13. This Strategy is intended as a long-term Strategy. We anticipate that it will be reviewed and updated in around 5 years time.
- 1.14. In deciding whether a Soil Strategy is required, we have considered whether there is a case for government intervention. We have concluded that taking into account the extent of the pressures on our soils, which are explained in Chapter 2 of the Strategy, and market failure to address these pressures, it is vital that the government does take action to protect our soil resources. The main annual costs that result from these pressures, as estimated by the Environment Agency⁴, are:
- the impact of soil erosion through pollution of water with sediment and other substances. This leads to clean-up costs for water companies and adversely affects fishing - approximately £77 million;
 - loss of productivity as a result of erosion – approximately £9 million;
 - reduced capacity to soak up water and reduce flood risk as a result of poor soil management – approximately £133 million;
 - loss of soil carbon a considerable proportion of which will end up as carbon dioxide (CO₂) in the atmosphere - approximately £85 million.
- 1.15. There are several reasons why we cannot expect the market to ensure that soils are adequately protected. Firstly, there are a number of externalities which include the costs to water companies, the effect on fish stocks and atmospheric CO₂ which will not feature in decision-making by land-managers. Secondly, there are public goods including reduced flood-risk and carbon storage which again will not be optimised by a farmer or land-manager. Thirdly, there is an issue of information - soil degradation through erosion and also contamination is a gradual process which may not even be noticed by farmers and land-managers and so they are unlikely to take effective and timely action to safeguard these resources even though it is in their interest to do so. Fourthly, it is likely that many land-managers will not think ahead into the longer term and will not therefore give sufficient weight to the interests of future generations.

⁴ EA(2002): Agriculture and natural resources: benefits, costs and potential solutions.

1.16. For the reasons explained above, it is vital that a Soil Strategy setting out a framework for governmental action with clear objectives and priorities is established and that we ensure that proportionate and effective policy measures are in place. In some cases, this will mean that new measures are required but on the whole this will mean adapting and updating current policy measures to ensure they are effective and proportionate. Each proposed policy measure will be assessed with respect to costs and benefits and Impact Assessments developed as appropriate.

Soils policy in the Devolved Administrations

1.17. Soils policy is a devolved issue but we work closely with the devolved administrations, keeping them informed of policy developments and adopting a coordinated approach where possible. Progress in each of the Devolved Administrations towards the development of their own soil policy is as follows:

1.18. **Scotland:** following the publication of a report 'Scotland's Soil Resource – Current State and Threats' in September 2006, the Scottish Government is developing a Scottish Soil Strategy which will be ready for public consultation at the end of April 2008. A focus of this Strategy will be organic soils in the context of climate change.

1.19. **Wales:** the Welsh Assembly Government published an Environment Strategy in May 2006, covering the issues of soil protection. This includes an action to develop a Soil Action Plan for Wales, the outcome being that soil is managed to safeguard its ability to support plants and animals, store carbon and provide other important ecosystem services. The Welsh Soils Action Plan is currently undergoing public consultation⁵.

1.20. **Northern Ireland:** the current focus in Northern Ireland is on soil sampling and soil surveys, though there is a commitment in place to develop a Soil Strategy.

Developments at EU level

1.21. In September 2006, the European Commission adopted a Thematic Strategy for Soil Protection aimed at raising awareness of potential threats and promoting an improved and more systematic response by Member States. This Strategy takes account of these aims, which are consistent with UK Government policy.

1.22. The European Commission has also tabled proposals for a Soil Framework Directive (see Box 2), which would place certain obligations on all Member States. EU Environment Ministers have not been able to reach agreement on these legislative measures. Any new EU requirements which are subsequently agreed would need to be reflected in the way this Strategy is taken forward.

⁵ <http://new.wales.gov.uk/consultations/currentconsultation/envandcouncurrcons/?lang=en>

Box 2: Proposals for an EU Soil Framework Directive

The European Commission have been working on a Thematic Strategy for Soil Protection since 2002⁶. It has taken the approach that soil should be managed and protected for the services it provides. It adopted the Thematic Strategy in September 2006, including a Communication, an Impact Assessment and proposals for a Soil Framework Directive. The Commission's proposals would involve very wide ranging measures covering protection of agricultural soils, soil contamination, soil sealing and a general duty on policy makers to take into account the impact of their policies and activities on soil and on land users to prevent and minimise negative impacts on soil. EU Environment Ministers have not been able to reach agreement on this approach. Any new EU requirements which do emerge would need to be reflected in the way our own domestic Strategy is taken forward, but are expected to be broadly consistent with our own resource protection.

Questions

Q1.1 Do you agree that a strategic document is required to set out domestic soils policy?

Q1.2 Do you agree with our decision to have a Soil Strategy rather than a second Action Plan?

⁶ <http://ec.europa.eu/environment/soil/index.htm>

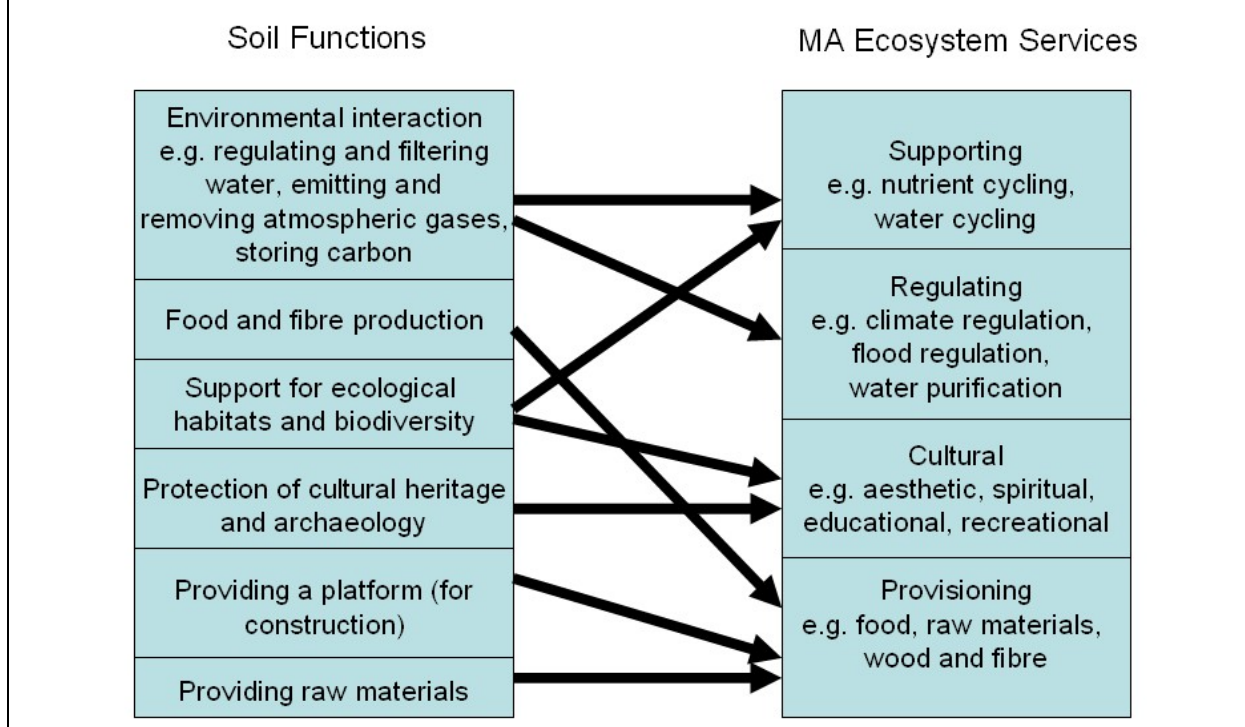
Chapter 2: Soil: Why is it important and what pressures are being faced

- 2.1. Soil is a fundamental and irreplaceable natural resource and provides an essential link between the components that make up our environment (i.e. air, water, biodiversity). Soil supports the delivery of ecosystem goods and services fundamental to our well-being and prosperity, which whilst not simple to evaluate in economic terms require consideration by Government in making policy and by all land users. The diversity and versatility of England's soils help shape the landscape including above ground biodiversity.
- 2.2. Soils perform a range of functions for society:
- environmental interaction (e.g. regulating the flow of and filtering substances from water, emitting and removing atmospheric gases, storing carbon);
 - support of food and fibre⁷ production;
 - support of habitats and biodiversity;
 - protection of cultural heritage and archaeology;
 - providing a platform (for construction); and
 - providing raw materials.
- 2.3. Soil functions can also be described in terms of the ecosystem services defined by the Millennium Ecosystem Assessment (MA)⁸. The MA is an international assessment process that provides a tool to assess the benefits of ecosystems for human well-being. It provides a useful system for quantifying the value of different soils in different areas with regard to the service(s) they provide. The diagram in Box 3 shows how soil functions relate to the services identified by the MA process.
- 2.4. This chapter explains the value of soil and some of the pressures acting on it. In preparing this draft Strategy we have begun by considering the functions played by soils, or their ecosystem services as well as the existing range of measures in place to determine the most appropriate way forward. We outline below where there are significant pressures on these ecosystem services and the policy implications of these pressures.

⁷ Fibre here refers to timber and non-food agricultural crops.

⁸ Millennium Ecosystem Assessment: (2005) Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

Box 3: Linkages between soil functions and MA ecosystem services



Provision of food and fibre

2.5. Soil is vital to the provision of food and fibre. Indeed soil is one of the fundamental assets of most farms, but mismanagement can result in its loss and degradation. This will reduce the ability of soils to perform this service as well as impacting on the provision of other ecosystem services.

2.6. In 2005 the total value of agricultural output for England was £10.1 billion⁹. Whilst many other factors contribute to this level of output, the majority of agricultural output relies on the use of soil (food crops, industrial crops and animal feed).

2.7. Good soil management and soil quality can increase profitability of farmers. For example, evidence suggests that by improving management of soil organic matter financial returns for farmers can be improved by a total of £31 to £66 per hectare¹⁰ (as a result of ease of tillage, fertiliser saving, and higher yields). Whilst the financial benefits are modest in absolute terms they are generally significantly higher than the costs involved in improving the management of soil organic matter.

2.8. In the 2007 Farm Practices Survey for England, farmers assessed the extent of soil erosion on their farms. In all 50% of farmers stated that they had experienced some indicator of soil erosion on their land – indicators included discoloured runoff entering ditches and water courses, sediment deposited in

⁹ Defra (2005): Agriculture in the UK 2005.

¹⁰ Gaunt et al (2004): To develop a robust indicator of soil organic matter status. See Defra Science website pages - Defra Project SP0310.

ditches and water courses, sediment deposited on roads and formation of gullies and rills¹¹.

2.9. The key costs of erosion are the water treatment costs associated with the presence of phosphate and sediment in sources of drinking water due to agriculture. The Environment Agency has compiled data on the costs of environmental damage caused by agriculture (based on 2004/05 prices)¹². It estimates the water treatment cost of soil erosion to be £21.17 million per year. This is based on an assumption that 50% of the cost is attributable to agriculture. More recent work suggests that agriculture is only responsible for 25% of the phosphorus¹³ but 75% of the sediment¹⁴. The additional off-farm costs incurred as a result of soil erosion (or costs of damage to property and dredging stream channels) were estimated to be £9 million per year, with on farm costs of soil erosion (due to wind and water) also being estimated at £9 million per year¹⁵. These costs therefore approximate an annual total cost of £30-40 million. This figure is likely to be an underestimate as it does not take into account the long-term impact on soils and the risk of reaching a situation where soil functionality has been severely diminished by the cumulative effect of erosion (particularly where the rate of erosion is greater than that of soil formation¹⁶) or the costs of restoring degraded habitats.

2.10. These costs are significant and in some geographical areas the costs are substantial. For all farmers, a focus on raising awareness of soil issues, current challenges (possibly exacerbated by the impact of climate change e.g. rainfall pattern), the impact of modern or inappropriate farming practices and identification of often basic good management of soil to minimise erosion, structural damage and build up organic matter levels, is required. Significant steps have been taken in recent years to ensure this. Cross-compliance requirements and Entry Level Stewardship options have been developed which can mitigate many of these issues over time at little cost to the farmer.

2.11. For areas where the risks are more serious, targeted measures are appropriate. The Water Framework Directive introduces such an approach. Defra and its agencies need to work with stakeholders to ensure that measures, including targeted advice campaigns (for example, Catchment Sensitive Farming) underpinning agri-environment schemes, are available to highlight cost-effective systems for soil management in key areas and that the Water Framework Directive is implemented in a way that contributes to soil protection. Land use change which protects the soil may in certain cases be a solution. We will need to monitor the impact of these existing measures and other policies on our soils, the costs to farmers, and modify policy if necessary.

¹¹ <http://statistics.defra.gov.uk/esg/publications/fps/default.asp>

¹² EA (2007): The total external environmental costs and benefits of agriculture in the UK.

¹³ Hammond et al (2006): Updating the estimate of the sources of phosphorus in UK waters.

¹⁴ Anthony et al (2006): Sediment Gap Analysis to Support WFD. See Defra Science website pages - Defra Project WQ0106.

¹⁵ Evans, R. (1996): Soil Erosion and its Impact in England and Wales. Friends of the Earth Trust.

¹⁶ In Britain soil forms at the rate of 0.3-1.3 tonnes per hectare per year.

- 2.12. Under current climate change predictions the UK will continue to get warmer, summers will get hotter and drier and winters milder and wetter. While some weather extremes are likely to become more common, such as summer heat waves and heavy winter precipitation, others will become less common, for example long winter cold snaps¹⁷.
- 2.13. These climatic changes are likely to have implications for the role of soil in food and fibre production due to changes in soil moisture balance, lengths of growing seasons and the suitability of crops and farming systems to altered temperature and rainfall patterns. Whilst increased temperatures may increase certain crop yields, greater flood risk may reduce the area of land available for agriculture. The need to use machinery on wet land is likely to result in poor and damaged soil structure, and erosion risk is likely to increase due to changes in soil water content.¹⁸ Wetter springs and drier summers have implications for grassland management and control of herbicide-resistant weeds.¹⁹ Wetter autumns have implications for root crop harvests, winter vegetables and the establishment of later crops.²⁰ Changes in soil moisture content affect several soil forming processes and it is uncertain how this, and changes in temperature, will affect carbon turnover. Changes in crop type and production are expected to mean greater irrigation needs, which puts increased pressure on regional water management policies.²¹ Less summer rainfall means that salinisation may occur from the potential loss of surface water.²² All of these effects have variable implications for the transport and fate of nutrients and pesticides, as well as losses of nitrous oxides, which in turn pose risks for food production. The indirect impacts of climate change on soil properties due to changes in cropping and land²³ use may turn out to be more significant than the direct impacts of changing temperature and rainfall patterns alone. However, with 57% of the UK's Grade 1 agricultural land lying below the 5 metre contour climate change induced sea level rise will also have a significant affect.
- 2.14. Changes in cropping and agricultural practices are driven by more than climate change and will have significant impacts on the soil. In particular,

¹⁷ Hulme, M., Jenkins, G. J., Lu, X., Turnpenny, J.R., Mitchell, T.D., Jones, R.G., Lowe, J., Murphy, J.M., Hassell, D., Boorman, P., McDonald, R. and Hill, S. (2002): Climate Change Scenarios for the United Kingdom: The UKCIP02 Scientific Report.

¹⁸ Bradley et al (2005): Impacts of climate change on soil functions. See Defra Science website pages - Defra project SP0538.

¹⁹ ADAS (2001): The timescale of potential farm level responses and adaptations to climate change in England and Wales. See Defra Science website pages - Defra project CC0333.

²⁰ ADAS (2001): The wet autumn of 2000: implications for agriculture. See Defra Science website pages - Defra project CC0372.

²¹ ADAS (2001): The timescale of potential farm level responses and adaptations to climate change in England and Wales. See Defra Science website pages - Defra project CC0333.

²² Bradley et al (2005): Impacts of climate change on soil functions. See Defra Science website pages - Defra project SP0538.

²³ The potential for soils to support agriculture, and the future distribution of land use, will be strongly influenced by changes in the soil water balance. Drier soil conditions may favour arable agriculture in the currently wetter regions of the UK as a result of improved soil workability, and diminished poaching risk in grassland areas. The range of current crops is expected to move northward and marginal crops such as maize may increasingly penetrate southern UK. (Defra (2000): Climate change and agriculture in the UK.) These spatial changes will impact on the distribution of pressures and threats to soil associated with these agricultural practices and crops.

increasing demand for cereals from the food, feed and fuel sectors will increase the pressure on agricultural land as UK farmers respond to market demand and increase cereals production. The current high world cereal prices are due both to this increased demand, but also smaller wheat harvests in 2006 and 2007. To alleviate some of the world-wide shortages of cereal supply, the EU Agricultural Council has set a 0% rate for set-aside in 2008. The main result of this change is likely to be more rotational set-aside being cropped for the 2008 harvest. If land in long term set-aside is also cultivated, it could also have an adverse environmental impact, including increased losses of soil carbon and will be monitored under Defra's Agricultural Change and Environment Observatory²⁴. There are also pressures to bring areas of non-arable land into production, such as the ploughing up of grassland for biofuels and the use of more marginal land for cereal production, both of which will have a similar, if not greater, impact on soil carbon.

Regulating soil carbon and climate change interactions

2.15. Soils are a major reservoir of carbon, with the order of 10 billion tonnes of carbon being stored in UK soils²⁵. The soils of the English uplands contain more carbon than all the trees in the UK and France added together²⁶.

2.16. Carbon is essential for the existence of all life. It is the major chemical constituent of organic matter (soil organic matter typically contains up to 58% carbon) an essential component of functioning terrestrial ecosystems. Soil organic matter (SOM) increases the capacity of soils to bind chemicals, buffers the release of pollutants, regulates the supply of nutrients, improves soil structure and makes soil more resistant to drought and erosion. Loss of soil carbon will be to the detriment of these soil functions.

2.17. In addition, loss of soil carbon as carbon dioxide (CO₂) to the atmosphere contributes to climate change. It is estimated that in 2003, 3.73 million tonnes carbon was emitted from UK soils and 1.52 million tonnes carbon was added to the soils. A further 0.24 million tonnes carbon was emitted directly from peat extraction²⁷.

2.18. A study by Bellamy et al (2005) suggests that over the last 25 years there has been a general decline in soil organic matter in agriculturally managed soils; though small increases have been observed in some intensively farmed arable soils. It is expected that the missing carbon is being lost to the atmosphere as CO₂ or to water as dissolved organic carbon, which will ultimately be lost to the atmosphere. Bellamy et al (2005) report that the carbon lost from UK soils was lost at an annual rate of 13 million tonnes, equivalent to 8% of the UK's current carbon emissions from consumption of fossil fuels²⁸.

²⁴ <http://defraweb/news/2007/070926b.htm>

²⁵ EA (2004): The state of soils in England and Wales.

²⁶ H M Government (2006): Climate Change: The UK programme 2006.

²⁷ Baggott et al (2005): UK Greenhouse Gas Inventory 1990 to 2003: Annual Report for submission under the Framework Convention on Climate Change.

²⁸ Bellamy et al (2005): Carbon losses from all soils across England and Wales 1978–2003. Nature Vol 437:245-8.

- 2.19. Although there is some uncertainty surrounding the Bellamy et al findings, in particular on the causes and fate of the lost carbon and some contradictory evidence from the Countryside Survey²⁹, if these findings are correct the loss of carbon from this vast pool is adding to greenhouse gas emissions at a rate of about 2% of the UK's current CO₂ emissions (about 8% of CO₂ emissions related to consumption of fossil fuels). This is not a substantial amount on its own but considered along with other effects explained above this is of significance and it is important to determine whether it is preventable and how this can be achieved. The annual cost, in terms of treatment, prevention, administration and monitoring, of the carbon lost due to soil cultivation in the UK has been estimated at £82 million.³⁰
- 2.20. Under the Kyoto Protocol, the UK is committed to reduce its greenhouse gas emissions by 12.5% below 1990 base year levels over the 2008-2012 commitment period. However, in 1997 the UK committed itself to go beyond the Kyoto Protocol target by setting a national goal to reduce carbon dioxide emissions by 20% below 1990 levels by 2010. The UK is already projected to reduce greenhouse gas emissions by nearly double its commitment under Kyoto³¹, but more is required to meet these new challenging domestic targets. The recently published Draft Climate Change Bill sets out a strong new legal framework to underpin the UK's contribution to tackling climate change. It commits the UK to at least a 60% reduction in carbon dioxide emissions through domestic and international actions by 2050, with 26-32% cuts by 2020. The Bill also includes a provision which would set up a new independent body – the Committee on Climate Change – to advise the Government on the optimal emissions reduction pathway and to report to Parliament annually on the UK's progress towards its goals.
- 2.21. Current policy to increase or maintain levels of SOM and to protect certain habitats such as peat bogs will assist in maintaining soil carbon. Government is currently involved in a range of direct and indirect activities which maintain levels of Soil Organic Matter and protect and restore habitats that store carbon such as peat bogs. For example, around 230,000 hectares of peat bog in England are under management in agri-environment schemes.
- 2.22. Our evidence suggests that further research is still required to establish the causes of reduced soil carbon and the amount lost to the atmosphere as well as the likely impact of climate change. We must also continue to explore ways of reducing carbon loss and of protecting and enhancing carbon stocks. This will need to be done with regard to the other benefits of soil organic matter as well.
- 2.23. There has been increasing interest in the potential of reduced tillage and organic matter additions to mitigate climate change by increasing the levels of carbon in the soil. A recent study critically reviewed the extent to which both reduced tillage practices (including zero tillage) and organic matter returns (farm

²⁹ EA (2002): MASQ: Monitoring and Assessing Soil Quality in Great Britain – Countryside Survey Module 6: Soils and Pollution.

³⁰ EA (2007): The total external environmental costs and benefits of agriculture in the UK.

³¹ HM Government (2007): Draft Climate Change Bill: Consultation document.

manures, biosolids, composts, paper waste, etc.) could increase the carbon content of arable soils under English and Welsh conditions³². It concluded that the UK-relevant body of evidence on reduced tillage was very small and inconclusive. Questions were also raised about the international evidence for the sequestration potential of reduced tillage compared to conventional tillage. On the basis of the evidence available, it concluded that the amount of carbon that could potentially be sequestered under zero tillage in England and Wales was likely to be small, with a best estimate of 310 (± 180) kilograms of carbon per hectare per annum, with experimental values ranging from -140 to 760 kilograms of carbon per hectare per annum. Reduced tillage is assumed to have half the carbon storage potential of zero tillage. However, even these small gains in carbon might be completely offset by an increase in direct nitrous oxide emissions, or reversed through ploughing which is in the UK generally undertaken every 3-4 years for compaction, weed, disease and pest control purposes even when reduced tillage is used.

2.24. The report on farming practices also suggested that small increases in soil carbon could be achieved by applying organic materials to land, raising typical soil carbon levels from 91 tonnes of carbon per hectare³³ to 91.6 – 92.5 tonnes of carbon per hectare³⁴. However, it suggested that only materials diverted from landfill should be regarded as genuine additional carbon storage, as the application of other materials to land was already part of good land management. This research needs further analysis and consideration to establish its policy implications.

Buffering pollution

2.25. Soils play an important role in buffering and transforming chemicals that could otherwise cause water or air pollution and/or contaminate our food. Soil microbes are capable of degrading and consuming a variety of contaminants, which can be exceedingly harmful in the wider environment. Soils degrade or retain more than 99% of the xenobiotics that they receive³⁵. However, when the buffering capacity of a soil is exceeded or the transformation ability compromised, further additions of chemicals will have a negative impact on soils and the wider environment.

2.26. Contaminants can enter the soil from many point and diffuse sources, including atmospheric deposition, inorganic fertiliser and organic manure applications to maintain agricultural soil fertility, and deposition by floodwaters. Soil contamination can have long-term implications for soil quality and the ability of a soil to fulfil a wide range of functions (e.g. food and fibre production, filtering/buffering of water supplies, conserving biodiversity).

³² Bhogal et al (2007): Climate change critical review. See Defra Science website pages - Defra Project SP0561.

³³ 91 tonnes is the typical carbon content of an arable soil in England and Wales assuming 28 g/kg soil organic carbon, 1.3 g/cm³ bulk density and 25 cm soil depth.

³⁴ This is based on application rates of 250 kg/ha total nitrogen (N) for livestock manures, digested biosolids and green waste compost, 150 kg/ha total N for primary or secondary chemical/physically treated paper crumble (equivalent to 75 t/ha fresh weight) and 7.5 t/ha of straw.

³⁵ EA (2006): Soil quality indicators. IPSS Meeting, Leeds.

- 2.27. Long-term heavy metal additions to land may mean that some soils cannot be used for food production where there are maximum permitted concentrations in food products (e.g. for cadmium and lead). Biomass and fibre production may also be affected by yield reductions. Additions of heavy metals to natural and semi-natural soils can also affect their ability to support ecosystems, habitats and biodiversity. Soil heavy metal impacts on soil processes are not yet fully understood, but can have profound implications for sensitive ecosystems, especially in conjunction with acidification or eutrophication.³⁶
- 2.28. Recent results from long term field experiments have indicated that metal-rich sewage sludges applied at vastly accelerated loading rates can have detrimental impacts on some fractions of the soil microbiota.³⁷ In summary, this research has shown that, under the conditions imposed by the trial:
- Heavy metal additions appear to have no consistent effect on soil respiration rates.
 - Zinc has been responsible for soil rhizobia population and microbial biomass size decreases at some sites when applied with sludge cake only (no such effects were observed in liquid sludge).
 - Copper additions (in both cake and liquid sludge forms) decreased the size of the soil microbial biomass.
 - Grain cadmium concentrations were mainly controlled by soil total cadmium levels and pH.
- 2.29. These experimental results give a preliminary indication of potential, worst case, long term scenarios. Although research is in place, we do not yet have the information to know whether the observed impacts are those of the high application rates over a short time period in this experimental set-up, or of the resulting total soil metal concentrations. Such total soil concentrations would occur only after applying sludges to agricultural land over the very long term, as sewage sludge is applied at much lower rates in practice, and in the present day has a lower metal content. We also do not know if the microbial community will adapt when subject to operational practice rates. It is imperative that we get these results in context before making large changes to the current regulatory regime.
- 2.30. Applying sewage sludge to land provides valuable plant nutrients and maintains soil organic matter which plays a key role in retaining good soil structure and water holding capacity. Application of sludge and other organic materials to land, for agricultural benefit or ecological improvement, is likely to be the Best Practicable Environmental Option in most circumstances, and when carried out in accordance with good practice. Metals may be introduced into soil from a wide variety of different organic materials. However, until further data on the bioavailability of metals from other organic materials is available, we can't be certain that metals from other sources would have similar effects; or if the effects observed to date in the Long Term Sludge Experiments are unique to metal-containing sewage sludges.

³⁶ Nicholson et al (2007): Sources and impacts of past, current and future contamination of soil. See Defra Science website pages - Defra Project SP0547.

³⁷ Gibbs et al (2007): Effects of sewage sludge on agricultural productivity and soil fertility (Phase III). See Defra Science website pages - Defra Project SP0130.

- 2.31. Levels of some contaminants in soils are falling, for example the UK Soil and Herbage Survey³⁸ revealed that concentrations of dioxins, one of the most toxic and persistent group of contaminants, have fallen in the UK by about 70% since the late 1980s when restrictions on emission from major industries were introduced. Concentrations of polychlorinated biphenyls (PCBs) had fallen 800-fold since restrictions on their production were introduced in the mid-1970s.
- 2.32. Deposition of atmospheric emissions of air pollutants such as sulphur and nitrogen compounds can have significant effects on sensitive ecosystems and on human health. Ammonia, sulphur dioxide and nitrogen oxides can lead to acidification, and in the case of nitrogen oxides and ammonia, also to eutrophication, of terrestrial (soil) and aquatic ecosystems. Deposition results in damage to biodiversity in semi-natural environments and upland rivers and lakes - many of which are of high conservation value (Sites of Special Scientific Interest and Natura 2000 sites). Our projections indicate that under current policies, significant areas of habitats in England will still be at risk (in exceedence of critical loads³⁹) from both acidification and eutrophication in 2010 (65.6% of the area of sensitive habitat, for which critical loads are mapped, are exceeded for acidity and 87.2% for nutrient N for 2010⁴⁰), despite significant reductions in air pollution emissions⁴¹.
- 2.33. Further research is needed to enable better assessment of long term impacts of inputs to soil from land management and deposition from air pollution; in particular, evaluation of long term soil monitoring programmes and their findings, in addition to case studies on impacts of air pollutants on soils under land management and the impact of acidifying and eutrophying pollutants on soil microbiology. This will feed into future policy development and will enable us to consider whether air quality and other policies need to be reviewed to ensure protection of our soils.

Water and flood regulation

- 2.34. Soil plays an important role in storing and transporting water. A single hectare of soil has the potential to store and filter enough water for 1000 people for 1 year⁴². We rely on the ability of well-managed soils to absorb rainfall and reduce run-off and to reduce the risk of flooding. When the infiltration capacity of soil is exceeded or compromised then the ability of soil to provide this function is reduced.
- 2.35. Climate change has the potential to increase probability of flooding due to increases in sea level and potential changes in the frequency, duration and

³⁸ Environment Agency (2007): UK Soil and Herbage Pollutant Survey.

³⁹ Critical loads - are usually defined as "a quantitative estimate of exposure to one or more pollutants below which significant effects on specific sensitive elements do not occur according to present knowledge" and where pollutants are deposited to land or water. Exceedence of critical load is used as an indication of the potential for harmful effects to ecosystems.

⁴⁰ Defra (2007): The Air Quality Strategy for England, Scotland, Wales and Northern Ireland.

⁴¹ Defra (2006): The Air Quality Strategy for England, Scotland, Wales and Northern Ireland: A consultation document on options for further improvements in air quality.

⁴² EA (2006): Soil quality indicators. IPSS Meeting, Leeds.

intensity of storms. In 2004 the Government's Foresight Future Flooding report⁴³ estimated that, taking these and other factors into account, annual average flood damages could increase by between 2 and 20 times by the end of the century. Changes will be highly dependent on the actual impact of climate change and sea level rise, patterns of growth, development (building etc) and future flood risk management activity.

- 2.36. The 2004 Government Strategy for flood and coastal erosion risk management in England 'Making space for water' recognises the role of soils in managing flood risk and has a wider scope than earlier strategies. Included for the first time are flooding due to run-off from impermeable surfaces such as roads, car parks and buildings and from saturated, frozen or compacted soil surfaces.
- 2.37. The sealing of soil in urban areas with impermeable materials such as concrete and tarmac increases the amount of rainwater run-off (by as much as 50%⁴⁴) and increases the risks of urban flooding. For example, in 2000, around 40% of the insurance claims made during the autumn floods did not appear to relate to fluvial flooding, highlighting the rising incidence of flooding caused by urban drainage problems. This represents claims totalling approximately £400 million⁴⁵. The use of alternative surfacing materials (e.g. permeable paving and gravel) may offer a solution in some situations as well as enabling soil to perform its role in groundwater recharge.
- 2.38. When the London Assembly examined aerial photographs of the capital in 2005, it found that 12 square miles (32 square kilometres) of front gardens were under paving; this is 67% of the total area of front gardens in Greater London and 3% of the total land area. This is the equivalent of 22 Hyde Parks⁴⁶. Continued increases in soil sealing is likely to add considerably to the pressure on our drainage systems and increase the risk of urban flooding.
- 2.39. Soil structural degradation due to compaction reduces the infiltration capacity of the soil and increases the risk of infiltration excess runoff leading to flooding. A recent major research study has shown that there is substantial evidence that current rural land management practices, such as cultivation practices and overstocking, have led to increased surface run-off at the local scale⁴⁷. The report noted, however, that there is a general absence or uncertainty of evidence of the impacts at the catchment scale. There is also a lack of knowledge of how small scale impacts combine at larger scales. Defra and the Environment Agency

⁴³ Evans, E., Ashley, R., Hall, J., Penning-Rowsell, E., Saul, A., Sayers, P., Thorne, C. and Watkinson, A. (2004): Foresight. Future Flooding. Scientific Summary: Volume I Future risks and their drivers. Office of Science and Technology, London.

⁴⁴ RHS (2005): Gardening matters: Front Gardens.

⁴⁵ Defra (2005): Making space for water: Taking forward a new Government strategy for flood and coastal erosion risk management in England, First Government response to the autumn 2004 consultation exercise: Updated Regulatory Impact Assessment.

⁴⁶ London Assembly (2005): Crazy paving: The environmental importance of London's front gardens.

⁴⁷ O'Connell et al (2004): Review of impacts of rural land use and management on flood generation: short term improvement in modelling and research plan. See Defra Science website pages - Defra Project FD2114.

are continuing to promote research to better understand the relationship between land management and flood risk at both local and catchment scale.

2.40. The annual cost of flooding due to soil structural degradation is difficult to assess, with estimates ranging from £24-51 million for the UK (1996 prices)⁴⁸ up to £115 million for England and Wales alone (2000 prices)⁴⁹. These estimates have been updated to 2004/05 prices to give a range of £29 million to £128 million⁵⁰.

2.41. Soil compaction also takes place in the built environment and the over-compaction of subsoil is almost an inevitable by-product of the construction process.⁵¹ Compaction at construction sites is very rarely removed or reduced before topsoil is spread and this affects the long-term functioning of the soils. This may be evident on-site, in the performance and visual quality of vegetated areas, as well as off-site through impacts on flooding, aquifer recharge and water quality.⁵²

2.42. We need to continue to address the problems caused by soil sealing and compaction and work with our public sector partners responsible for flood protection, water quality and resource, and spatial planning at national, regional and local levels to take this into account in policy-making and implementation. This includes promotion of the identification and implementation of soft engineering solutions, such as Sustainable Urban Drainage and Integrated Urban Drainage Plans, to alleviate flooding. We will continue to explore the environmental and economic costs of soil sealing, considering predictions for more extreme weather conditions under a changed climate, and to explore the actions that can be taken to reduce these costs taking into account social and economic pressures for development.

Soil biodiversity

2.43. Soil biota perform a major role in soil processes by decomposing organic residues, recycling nutrients and contributing to soil structure through their living tissue, waste products and remains. Decomposition by soil organisms is a central process for the delivery of most ecosystem services.⁵³ These services include animal and food production, the provision of biochemicals and medicines and the regulation of fresh water. Soil organisms support carbon sequestration, trace gas composition, nutrient cycling, soil formation and structural habitat provision. They also play a role in detoxification and waste treatment and in erosion control. Soil ecosystems support biodiversity for a wide range of farmland birds and other predators and therefore sustaining below ground ecology is important in retaining

⁴⁸ Evans, R. (1996): Soil Erosion and its Impact in England and Wales. Friends of the Earth Trust.

⁴⁹ EA (2002): Agriculture and Natural Resources: Benefits, Costs and Potential Solutions.

⁵⁰ EA (2007): The total external environmental costs and benefits of agriculture in the UK.

⁵¹ WSP Environmental Ltd (2006): The impact of subsoil compaction on soil functionality and landscape. See Defra Science website pages - Defra project SP08005.

⁵² Land Research Associates Ltd (2006): Use of surplus soil at development sites. See Defra Science website pages - Defra project SP0701.

⁵³ Stockdale, E.A., Watson, C.A., Black, H.I.J., and Philipps, L. (2006): Do farm management practices alter below-ground biodiversity and ecosystem function? Implications for sustainable land management. See Defra Science website pages - Defra project SP08012.

above ground biodiversity. Having a range of soil organisms that respond differently to different environmental perturbations, for example different pollutants, is more likely to enable ecosystems to respond to disturbances and variations and to allow greater flexibility in management practices whilst maintaining soil function.⁵⁴ Some studies have shown that a decline in below ground biodiversity will reduce the ability of the soil to withstand and recover from perturbations.⁵⁵

2.44. It has been estimated that only 1 to 5% of all microorganisms on Earth have been named and classified. A large proportion of these unknown species are thought to reside in the soil. Estimates of the possible number of existing species of different groups are staggering: 1.5 million species of fungi, 300,000 species of bacteria, 400,000 species of nematodes and 40,000 species of protozoa⁵⁶. New molecular techniques have been used to estimate that a single gram of good quality arable soil can contain as many as 600 million bacteria from up to 20,000 species. The microbial biomass from a hectare of arable soil has the same mass as 300 sheep⁵⁷. The vast unexplored biodiversity of soils has potential for commercial exploitation in biotechnology, in areas such as medicine, industrial processes, agriculture and bioremediation of polluted wastes, waters and land. Most clinically relevant antibiotics today originate from soil-dwelling actinomycetes⁵⁸ and the potential uses of other organisms and their products are being actively pursued. For example, enediynes are a natural toxin produced by soil bacteria which have been found to be one the most effective known anticancer agents⁵⁹.

2.45. It is important to understand soil biodiversity and its relationship with soil functions, and the environmental factors, including human activities, that affect soil diversity and functions. There has been some research into this already⁶⁰ and this needs to be rigorously assessed in order to determine the focus of future research. We need to continue to encourage fundamental research to help understand the potential impacts of society on soil biodiversity as well as its ecological and economic value and potential. There is a clear role here for the UK Research Councils, amongst others.

Questions

Q2.1 Do you agree with our analysis of the evidence of pressures on soils?

Q2.2 Do you have any other evidence/valuations that we should consider?

⁵⁴ Stockdale, E.A., Watson, C.A., Black, H.I.J., and Philipps, L. (2006): Do farm management practices alter below-ground biodiversity and ecosystem function? Implications for sustainable land management. See Defra Science website pages - Defra project SP08012.

⁵⁵ Griffiths, B.S., Bonkowski, M., Roy, J. and Ritz, K. (2001): Functional stability, substrate utilisation and biological indicators of soils following environmental impacts. *Applied Soil Ecology* **16**, 49-61.

⁵⁶ SNH (2002): Soil Biodiversity. Information and Advisory Note No. 151.

⁵⁷ Ritz (2005): Underview: origins and consequences of below-ground biodiversity. *Biological Diversity in soil*, Bardgett et al (eds.), British Ecological Society publication.

⁵⁸ T. Kieser, M. J. Bibb, M. J. Buttner, K. F. Chater, D. A. Hopwood (2000): *Practical Streptomyces Genetics*. John Innes Foundation, Norwich, UK.

⁵⁹ <http://news.bbc.co.uk/1/hi/health/2196277.stm>

⁶⁰ <http://soilbio.nerc.ac.uk/>

Chapter 3: Our vision and objectives

Vision

3.1. The vision follows on from that set out in the First Soil Action Plan and recognises the importance of climate change on ecosystem service provision:

Our vision is that England's soils will be protected and managed to optimise the varied functions (or ecosystem services) that they perform for society in keeping with the principles of sustainable development and in the context of climate change.

3.2. The functions of soil and the ecosystem services they perform are set out in Box 3.

Objectives

3.3. In light of our assessment of the key risks and threats to our soil (see Chapter 2), our objectives over the medium and long terms of this Strategy are to:

- Ensure that measures for the protection of soil functions in respect of agricultural and forest soils are effective, targeted and proportionate, take into account future pressures including our changing climate and minimise any adverse impacts on air, water, biodiversity and greenhouse gas emissions.
- Reduce the rate of soil organic matter decline and protect habitats based on organic soils, such as peat bogs, to maintain our carbon stores (to mitigate climate change) and soil quality.
- Establish the degree of risk from putting organic materials on soils and the consequences for human, animal and plant health and the environment, and seek to keep these risks at an acceptable level.
- Ensure that, in accordance with the principle of sustainable development, the construction industry and planning authorities take account of the need to protect soil resources, and ensure soils in the built environment are able to fulfil as many as possible of their functions, especially storing, transporting and filtering water.

Priority work areas

3.4. Achievement of these objectives will require Defra to work closely with different groups of stakeholders and Government bodies. Priority work areas have been identified which are topic or sector specific. Each work area relates to the delivery of more than one objective. The work areas are not mutually exclusive and there is a degree of overlap and inter-linkage between them.

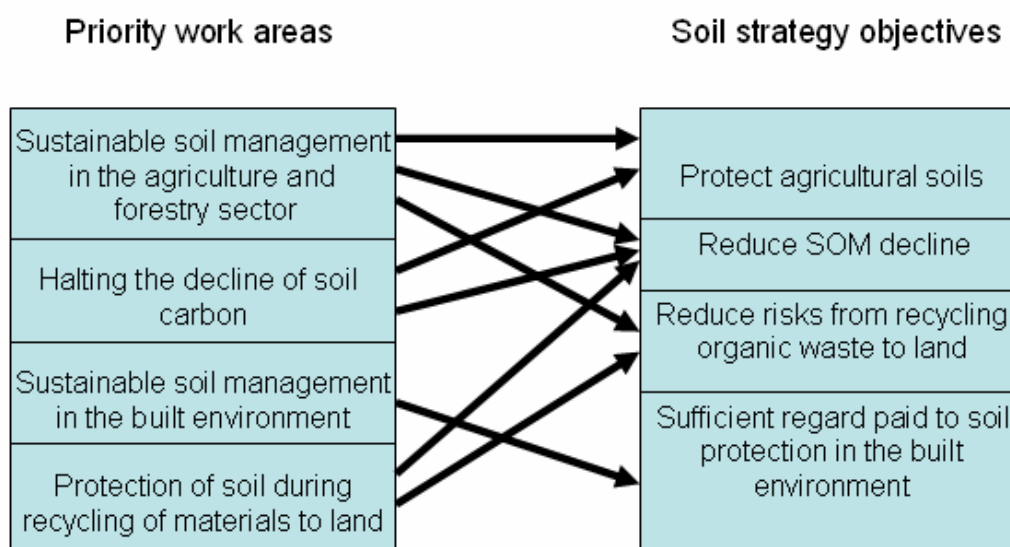
3.5. The priority work areas identified to deliver these objectives are listed below and then explored in more detail in the referenced Chapters. The linkages between the priority work areas and our objectives are set out in Box 4. The priority work areas are:

- **Sustainable soil management in the agriculture and forestry sector** (Chapter 4): allowing existing measures to embed, review effectiveness, both

current and in the light of climate change, and determine additional requirements;

- **Halting the decline of soil carbon** (Chapter 5): understanding the losses and gains of soil carbon and how those might be influenced;
- **Sustainable soil management in the built environment** (Chapter 6): providing the information and tools to improve sustainable soil management in the built environment; and
- **Protection of soil during the recycling of organic materials to land** (Chapter 7): achieving a balance between recycling to land and soil protection.

Box 4: Linkages between priority work areas and objectives



3.6. In parallel to these four priority work areas we will also work on the following to assist in delivery of our objectives:

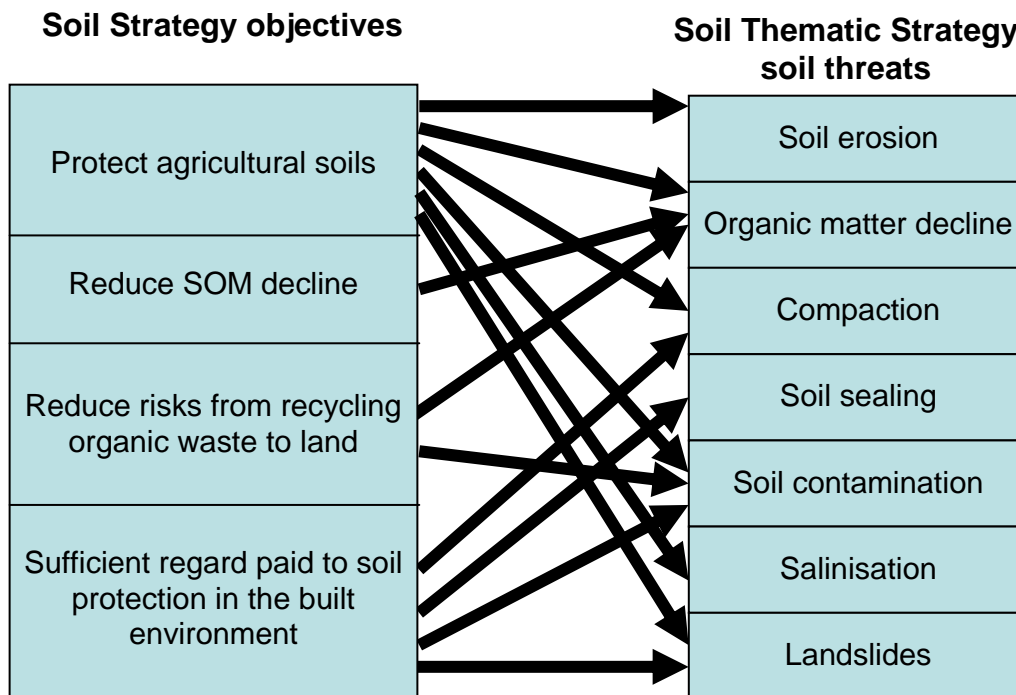
- **Evidence** (Chapter 8): ensuring the evidence base is available to underpin and evaluate policy;
- **Stakeholders** (Chapter 9): working with partners and stakeholders; and
- **Monitoring and evaluation** (Chapter 10): monitoring and evaluating the success of policy measures and the Soil Strategy.

3.7. The priority work areas represent those areas where Defra believes the greatest effort should be expended in order to meet our objectives. However, there are other areas of work that will also need to be undertaken towards the achievement of our vision and the sustainable management of soil. Aspects of these topics may fit into some of the Defra priority work areas. These topics will be priority issues for those working in these areas. These areas include:

- soil biodiversity;
- soils and cultural heritage;
- soils in semi-natural habitats; and
- soils and education.

3.8. While the objectives and priority work areas of this Strategy reflect our analysis of the domestic situation in terms of soils, we have also taken into account the analysis that underlies the EU proposals of September 2006. See Box 5 for how the objectives of this draft Strategy map onto these threats.

Box 5: Links between Soil Strategy objectives and the threats to soil identified in the EU Thematic Strategy for Soil Protection



Public Service Agreements 2008-2011

3.9. On 9 October 2007, the Government published the results of the Comprehensive Spending Review 2007 (CSR 2007). As well as spending settlements for all departments, it contains a new set of cross-Government priorities or Public Service Agreements (PSAs), to replace those which were agreed in the previous Spending Review (SR04). These will be key priorities for the Government for the period from April 2008 until March 2011.

3.10. Defra will lead two cross-Government PSAs in the new CSR period, one on Climate Change - **Lead the global effort to avoid dangerous climate change** - and the other on the Natural Environment - **Secure a healthy natural environment for today and the future**. The work of the Soil Strategy will mainly contribute to the Natural Environment PSA, but will contribute to the Climate Change PSA by working to reduce greenhouse gas emissions, in particular CO₂.

3.11. The Government's vision for the Natural Environment PSA is to secure a diverse, healthy and resilient natural environment, which provides the basis for everyone's well-being, health and prosperity now and in the future; and where the

value of the services provided by the natural environment are reflected in decision-making. It wants to see:

- the air that people breathe free from harmful levels of pollutants;
- sustainable water use which balances water quality, environment, supply and demand;
- land and soils managed sustainably;
- biodiversity valued, safeguarded and enhanced;
- sustainable, living landscapes with best features conserved;
- clean, healthy, safe, productive and biologically diverse oceans and seas; and
- people enjoying, understanding and caring for the natural environment.

3.12. Progress will be measured against a suite of five key indicators, with aspects of soil management picked up under a land management indicator - the positive and negative impacts of agricultural land management to the natural environment. The key indicators will be supported by a broader set of indicators in each of the policies and programmes which contribute to delivering the PSA, to provide a comprehensive picture of the state of our natural environment.

3.13. The Soil Strategy will also contribute to a number of Defra's new Departmental Strategic Objectives.

Integration with existing policy

3.14. The Soil Strategy will complement and integrate a range of existing and developing policies that have a bearing on soil as highlighted throughout the document.

3.15. An Action Plan for embedding an ecosystems approach to policy and decision making across the terrestrial natural environment in England was published in December 2007⁶¹. This work aims to deliver a more holistic and integrated approach to policy and decision making across the natural environment, to maintain and enhance the supply of ecosystems services, and to reflect the true value of the natural environment in decision making. As outlined in Chapter 2 soils perform a range of functions (or ecosystem services) and this Strategy has been drafted to maximise the benefits that soils can bring and optimise the delivery of ecosystem services.

3.16. The Action Plan will ensure that soil functions, and the pressures on them, are an active consideration of the Government and key stakeholders. Whilst this is an ambitious agenda, there are clear benefits to being able to better quantify the true costs and benefits of policies and to develop sustainability in the truest sense.

3.17. We will seek to ensure that work is integrated with the work on Land Use⁶² (see paragraph 6.22).

⁶¹ <http://www.defra.gov.uk/wildlife-countryside/natres/develop.htm>

⁶² Land Use work was initiated in David Miliband's speech of 9 March 2007 to the CPRE.

3.18. These sit within the wider context of Defra's goal of enabling everyone to live within our environmental means, delivering sustainable development. The UK Sustainable Development Strategy⁶³ sets out how Government will work towards delivering sustainable outcomes through integrating social, economic and environmental concerns.

Questions

Q3.1 Views are invited on our vision.

Q3.2 Views are invited on our objectives. Do you agree with our proposed objectives? Is it important that we set these objectives? Have we missed anything significant?

Q3.3 Views are invited on the priority and supporting work areas. Do you agree that these should be the priority areas for future work on soils? Have we missed anything significant or included areas which are not important?

Q3.4 What are your views on the topics which have not been identified as a priority for Defra action (see paragraph 3.7)?

⁶³ HM Government (2005): Securing the future: UK Government Sustainable Development Strategy.

Chapter 4: Priority area 1: Sustainable soil management in the agriculture and forestry sector

Background

4.1. Farmers and land managers manage approximately 80% of the land, and by extension, the soil, in England. Their activities are vital in delivering one of the ecosystem services that soil provides, i.e. food and fibre production. However, there are risks of soil degradation from agricultural activities through both physical loss (erosion) and the reduction in quality of soil associated with damage to soil structure, nutrient decline, organic matter loss and contamination. Soil degradation impacts on the potential of soil to provide food and fibre in the future and impacts adversely on water quality and aquatic and terrestrial biodiversity. Our key concerns in respect of soil degradation in this sector are explained below.

Soil erosion

4.2. Studies have shown that agriculture is the main source of sediment in some rivers through soil erosion and exacerbated channel bank erosion. Eroded soil particles carry bound pollutants such as phosphorus, pesticides, heavy metals and micro-organisms; 60% of the phosphorus lost from agriculture is associated with soil erosion⁶⁴. Typical soil erosion rates are in the order of <1-20 tonnes/hectare/year²⁹ with most fields experiencing <1 tonnes/hectare/year⁶⁵, but erosion rates as high as 100 tonnes/hectare have been reported²⁹. Such significant losses of soil can impact on crop production as well as water quality.

4.3. Siltation of rivers affects the lifecycle and diversity of fish, invertebrates and plants and the over-enrichment of rivers and lakes by phosphorus gives rise to changes in the biodiversity of the habitat. Eroded soils have degraded trout and salmon spawning beds in a number of rivers in England⁶⁶.

Soil organic matter decline

4.4. Soil organic matter improves the workability and fertility of soils, helps to maintain good structure and reduces the risk of capping, slumping and erosion. Continuous arable cropping reduces soil organic matter and positive action may be needed on some soils to maintain or increase current contents (see also Chapter 5). Organic matter is added to soil by returning crop residues; introducing cover crops, grass leys or longer periods of grass into the rotation; or applying bulky organic materials. Although there are multiple benefits from applying organic materials to land there are also a number of associated risks, e.g. diffuse nutrient pollution and soil pollution (see also Chapter 7).

Effects of climate change

4.5. As set out in Chapter 2 (see paragraphs 2.12-2.14) climate change and increasing competition for land to grow crops will have both direct and indirect effects on soil. Particular concerns relate to potential increases in soil erosion,

⁶⁴ Defra (2003): Strategic review of diffuse water pollution from agriculture: Stakeholder discussion paper.

⁶⁵ Harrod et al (1998): A systematic approach to national budgets of phosphorus loss through soil erosion and surface runoff at National Soil Inventory nodes. Defra report NT1014.

⁶⁶ Environment Agency (2005): State of the Environment 2005.

organic matter turnover and flood risk as well as the impacts on crop production of potentially lower soil moisture levels. There is a need to further understand these impacts and to develop adaptation strategies in order to protect soils and support the continued provision of ecosystem services.

Progress to date

4.6. Good progress has been made under the First Soil Action Plan to improve the sustainable management of soils in the farming and food sector. Cross-compliance (see paragraph 4.9), Environmental Stewardship (see paragraph 4.11), Catchment Sensitive Farming (see paragraph 4.16) and work to implement the Water Framework Directive (see paragraph 4.15) have all contributed to raising the awareness of land managers of the impact of their actions and providing guidance on best practice for future soil management. It is however important to review these measures and consider their effectiveness and whether they could be improved.

Objectives

4.7. This Strategy will build on this progress with the aims of achieving the objectives set out below and contributing to the delivery of the Sustainable Farming and Food Strategy (Forward Look 2006) target of ‘A farming industry that understands and acts on its impact on the environment, particularly in respect of water quality and soil management’⁶⁷.

4.8. This work area will particularly address the following objectives:

- **Ensure that measures for the protection of soil functions in respect of agricultural and forest soils are effective, targeted and proportionate, take into account future pressures including our changing climate and minimise adverse impacts on air, water, biodiversity and greenhouse gas emissions** – by evaluating the effectiveness of existing policy measures before determining if further measures are required and ensuring that any new measures are effective, targeted and proportionate. By promoting soil management practices that are adaptable to the changes in climate and reduce impacts on air, water, biodiversity and greenhouse gas emissions, particularly of CO₂.
- **Reduce the rate of soil organic matter decline and protect habitats based on organic soils, such as peat bogs, to maintain our carbon stores (to mitigate climate change) and soil quality** – by establishing management practices that can lead to a sustainable increase, or reduced loss, of soil organic matter to deliver our Sustainable Farming and Food Strategy target “to halt the decline in soil organic matter in vulnerable agricultural soils by 2025” (see Chapter 5).
- **Establish the degree of risk from putting organic materials on soils and the consequences for human, animal and plant health and the environment, and seek to keep these risks at an acceptable level** – by developing a programme of work to tackle diffuse soil pollution.

⁶⁷ Defra (2006): Sustainable Farming and Food Strategy: Forward Look.

Ongoing action and areas for development

Cross-compliance

4.9. As part of cross-compliance, four Good Agricultural and Environmental Condition (GAEC) standards were adopted in January 2005 to better protect agricultural soils, focussing on erosion, soil structure and soil organic matter decline (see Box 6 for details). Farmers must comply with these standards in order to receive their full Single Payment Scheme payments. Cross-compliance guidance for soil management was published in January 2005, with an updated version (following stakeholder comments) published in December 2005. The Soil Protection Review was also published in December 2005 following farmer testing. This requires farmers to identify and record relevant soil issues on their farm and select and implement appropriate measures (with regard to the guidance) to tackle these. Specific guidance and directions can be given where there are clear failings or an identified need. This measure means that approximately 91% of the total agricultural land in England⁶⁸, excluding common rough grazing, is now subject to a Soil Protection Review.

Box 6: Soil GAEC Standards

The four soil GAEC standards are:

- GAEC 1: General requirements (including by 1 September of the year of entry into the scheme (commencing 2006), complete a simple risk-based Soil Protection Review. Actions identified in the review must be implemented from 1 January the following year, and reviewed on an (at least) annual basis)
- GAEC 2: Post-harvest management of land after combinable crops
- GAEC 3: Waterlogged soil
- GAEC 4: Burning of crop residues

Further details are available in the Cross-Compliance Handbook for England, Guidance for soil management and Soil Protection Review⁶⁹.

4.10. Cross-compliance aims to raise awareness amongst land managers of soil management issues and provides a mechanism for seeking to ensure that risks to soil from erosion, organic matter decline and structural damage on farmland are reduced. As data becomes available through surveys as part of a Defra Farm Advice programme⁷⁰ and monitoring activities **Defra will need to consider whether current cross-compliance standards effectively and proportionately deliver good soil management across England's farmed land, and will consider how to optimise the delivery of soil-related ecosystem services so that administrative burdens are kept to a minimum.**

Environmental Stewardship

4.11. Additional changes in management practices, beyond those promoted in cross-compliance, are required to tackle certain soil issues. These require more management time and skills. To encourage improved practice there are a

⁶⁸ Defra (2007): Uptake of the single payment scheme by farmers. Defra Agricultural Change and Environment Observatory Research Report No. 05.

⁶⁹ <http://www.rpa.gov.uk/rpa/index.nsf/home>

⁷⁰ <http://www.crosscompliance.org.uk/>

number of soil specific options included under Environmental Stewardship (ES), which was launched in 2005, including, under Entry Level Stewardship (ELS), the management of maize crops to reduce erosion, over-wintering of stubbles and under-sowing of spring cereals to reduce the amount of bare soil vulnerable to erosion. Farmers could also opt for preparing a Soil Management Plan (SMP)⁷¹, though this option was removed from the programme in late-2007. There are further soil protection options under Higher Level Stewardship (HLS), such as in-field grass areas to prevent erosion or run-off and preventing erosion or run-off from intensively managed improved grassland.

4.12. A **review of progress of Environmental Stewardship** began in May 2007 and it focuses on certain soil related issues:

- climate change mitigation options;
- the development of a value for money successor to Soil Management Plans;
- the boundary between cross-compliance and ELS;
- the development of the successor to the Hill Farm Allowance (likely to be an upland strand of ELS);
- how to maximise the contribution of ES to our obligations under the Water Framework Directive;
- the extent to which ELS might contribute to delivering, in combination with cross-compliance, the requirements of a Soil Framework Directive.

Defra will need to ensure that ES, along with cross-compliance, optimises the delivery of soils related ecosystem services. Defra will seek to ensure these measures are properly integrated with each other.

Climate change

4.13. Agriculture is responsible for around 7% of the UK's total greenhouse gas emissions. It accounts for around 37% of our methane emissions, and around 67% of our nitrous oxide emissions. It is also responsible for a smaller proportion of carbon dioxide emissions (for example from the consumption of fuel for vehicles, and electricity and heat for buildings), and has an important role in protecting stores of carbon in woodlands and soils, and in providing biocrops and biomass as alternatives to fossil fuels. Defra's Agriculture and Climate Change project forms part of the Farming for the Future Programme and aims to enable the agriculture sector to (a) fulfil its potential in contributing to climate change mitigation and (b) adapt in order to manage the impacts and in so doing make the most of the opportunities presented by climate change, and help minimise the impacts of climate change on land, ecosystems and society as a whole. **Defra is working with stakeholders, through the Rural Climate Change Forum, to help the sector reduce its emissions** and has a dedicated Agriculture and Climate Change R&D programme to help build the evidence base. The importance of halting the decline of soil carbon is looked at in more detail in Chapter 5.

4.14. As well as mitigating climate change, soil management practices have a role to play in our adaptation to a changed climate. Lessons need to be learned from

⁷¹ The Soil Management Plan involved an assessment to identify varying degrees of risk of both runoff and erosion across the farm and records how any soil issues or problems will be dealt with on a field-by-field basis. While the SPR is concerned with soil management at a *farm* level, the SMP was focussed at the *field* level.

the experience of countries that already encounter our predicted future climate, particularly Southern Europe, where the degradation of soil resources is very apparent (e.g. large scale erosion), and management practices promoted that prevent such degradation here. **Defra will explore the impacts of climate change on soils and consider the implications for soils guidance.**

Protection of water quality

4.15. There are a number of policies related to water quality protection that can bring significant benefits to England's soils. Measures to tackle soil erosion and structural damage, which can exacerbate erosion, are a key aspect of the **implementation of the Water Framework Directive (WFD)**. In particular, the WFD requires Member States to tackle sediment loss where this is having an adverse impact on the ecological quality of water bodies. Changes to the physical characteristics of water bodies, known as hydromorphological pressures, must also be tackled for the same reason. Programmes of Measures to address these risks and pressures, including from agricultural and non-agricultural sources as well as from hydromorphology have to be established by 2009 and made operational by 2012. These measures are the focus of a recent consultation exercise.⁷²

4.16. In the meantime, the England Catchment Sensitive Farming (CSF) Delivery Initiative was launched on 1 April 2006 to tackle diffuse water pollution from agriculture (DWPA) by raising awareness of diffuse water pollution and encouraging early voluntary action by farmers to tackle the problem in 40 priority catchments. In particular, Catchment Sensitive Farming Officers are looking to build on Soil Protection Reviews (required under cross-compliance) and to promote a range of other soil protection measures as part of Catchment Sensitive Farming. The CSF Delivery Initiative will provide a large scale demonstration of what can be achieved by a supportive approach to minimise soil erosion in sensitive catchments. Evidence will be collected on the impact of these measures in respect of reducing sediment reaching water courses and delivery against targets on diffuse pollution.

Nutrient management

4.17. Nutrient management is a cross-cutting workstream of the Farming for the Future Programme. The Nutrient Management (NM) Workstream was launched in April 2007 with an initial remit for five years. The NM Workstream was created to coordinate existing departmental work to **optimise the use of nutrients** through maximising the efficiency of the nutrient cycle on farm (e.g. through the provision of more coherent integrated advice) and thereby **helping deliver environmental outcomes for air, water, soil, climate change and biodiversity**. Soil management and protection will form an important part of this workstream and many of the work strands included throughout this Strategy will also feed into this workstream.

Forestry

4.18. Woodlands cover almost 9% of England's land area. Trees can help improve soil structure by increasing porosity, water infiltration and by encouraging soil

⁷² Defra (2007): The Protection of Waters against Pollution from Agriculture: Consultation on diffuse sources in England.

microbes that help to bind soil particles together. They will also help to reduce erosion by protecting the soil from the direct impacts of rain and wind, slowing runoff, increasing infiltration and reducing organic matter loss. Woodlands therefore increase soil carbon stocks, reduce soil erosion, alleviate flooding, protect water resources and act to protect archaeological resources in the soil. Woodland creation is a recognised tool for delivering many environmental objectives and will contribute towards meeting the objectives of the Soil Strategy (as well other policy initiatives such as the Water Framework Directive).

- 4.19. England's recently revised Forestry Strategy, 'A Strategy for England's Trees, Woods and Forests'⁷³ continues to recognise the role of woodland in the protection of environmental resources, including soil. Forestry policy ensures that where new plantations occur, they are sited in areas that optimise soil protection (through the physical structural advantages conveyed through tree roots and provision of drainage and nutrients). The Forests and Soil Conservation Guidelines⁷⁴ represent best practice and **are currently being revised** to reflect recent changes in policy and knowledge. This includes advice to ensure that existing plantations are sustainably managed.

Flood risk management

- 4.20. As part of the 'Making Space for Water'⁷⁵ programme, the role that land management practices can play in reducing flood risk at the local scale is being investigated. The project will identify which land management practices can contribute to reducing flood risk, how these practices can be delivered and where other public benefits can be provided. Further research is also being undertaken into the role rural land management techniques might play in managing flood risk at catchment level. This was an area where the Making Space for Water consultation identified a gap in the current evidence base. **These projects will be completed in 2008.** England's Forest Strategy also promotes the contribution of woodland to reducing flood risk. The EA are committed **to take soil and land management issues into account when making decisions on their work on flood risk management, through River Basin Management Plans and Catchment Flood Management Plans and to work with farmers to improve soil management on farms to reduce localised flooding.**⁷⁶

Air quality

- 4.21. Over the course of 2008, at EU level, the Commission are expected to put forward proposals for the revision of the National Emissions Ceiling (NEC) Directive. At the United Nations Economic Commission for Europe (UNECE), the Gothenburg Protocol to abate acidification, eutrophication and ground level ozone and the Heavy Metals Protocol under the Convention on Long Range Transboundary Air Pollution (CLRTAP) are currently being reviewed. The reviews will consider the effectiveness of the Protocols in moving towards meeting the objectives of the Convention and feed into discussions on whether revision of the Protocols is necessary.

⁷³ Defra (2007): A Strategy for England's Trees, Woods and Forests.

⁷⁴ Forestry Commission (1998): Forests and soil conservation guidelines.

⁷⁵ Defra (2005): Making space for water: Taking forward a new Government strategy for flood and coastal erosion risk management in England.

⁷⁶ EA (2007): Soil: a precious resource.

4.22. The revision of the NEC Directive and reviews of the two UNECE Protocols, and specifically, potential future revisions of the Protocols, have important implications for soil, as revisions can potentially help to further protect sensitive semi-natural habitats and their soils from acidification, eutrophication and deposition of heavy metals. Although impacts on soil microbial health are integral to assessment of impacts of deposition of heavy metals on ecosystems the links between soil microbiology and soil function and processes need first to be more fully established. As these communities are considered key components of ecosystem quality and maintenance, further consideration of the impacts of deposition of other pollutants on these communities would then ensure greater and wider benefit to the environment.

4.23. **Defra will consider how best to improve our understanding of the impacts of air pollutants on ecosystems, including soil communities, and how best to include consideration of these impacts as part of future revisions of the Gothenburg Protocol.**

Diffuse soil pollution

4.24. Pollutants (e.g. heavy metals, organic pollutants) can enter the soil from many point and diffuse sources. These include atmospheric deposition, inorganic fertiliser and a wide range of beneficial organic materials (including manure, biowaste and some industrial wastes) to maintain agricultural soil fertility, and deposition by floodwaters. Soil pollution can have long-term implications for soil quality and the ability of a soil to provide a wide range of ecosystem services. Research has been undertaken to identify the major past, current and future sources of soil pollutants, and to assess their potential impacts on soil functions. **Defra and the Environment Agency are assessing the policy implications of this work and will develop a policy response.** Work to ensure that organic materials can be recycled to land without giving rise to diffuse pollution is also considered under priority area 4 (Chapter 7).

Reducing farming's environmental footprint

4.25. Policy development is ongoing **to look at ways of benchmarking the environmental impact of farming and give guidance on good and best practices that farmers could use to improve their performances.** The impact of farming on soil quality will be considered as well as the wider environmental impacts of poor soil management.

4.26. A new draft Code of Good Agricultural Practice (COGAP) for England⁷⁷ has **been subject to recent consultation and will replace** the three existing Codes of Good Agricultural Practice for the protection of Water, Soil and Air. The revised COGAP, to be published during 2008, is a single consolidated document which focuses on high level, integrated messages on environmental protection based around the main operations that farmers might undertake. Key actions are described which can be taken to protect and enhance the quality of soil by maintaining soil fertility and managing soil contamination.

⁷⁷ <http://www.defra.gov.uk/corporate/consult/cogap-rev/index.htm>

Success

4.27. Successful delivery of this priority work area would mean that soil management is an active consideration in farm business planning; that good management is rewarded and that poor management is addressed so that measures are put in place which improve performance and focus on areas of high risk; that this work delivers benefits in terms of improvements in soil structure (including organic matter content), water quality, reduced flood risk and reductions in nutrient pollution; without imposing high administrative burdens on farmers; and that policies and management practices are adapted to respond to a changing climate.

Key next steps

4.28. The following actions have been identified. They are the proposed next steps only and the achievement of these actions will not on their own lead to the delivery of this priority work area's objectives and success criteria:

- Review the impact of Soil Protection Reviews (SPR) during 2008/09 using the findings in development of the next iteration of the SPR or its successor.
- Review Entry Level Stewardship/Higher Level Stewardship soil options in relation to cross-compliance. Continue to feed into the wider Environmental Stewardship review in 2008 and development of future uplands rewards structure to replace the Hill Farm Allowance from 2010.
- Review the major past, current and future sources of soil pollutants, and assess their potential impacts on soil functions (reported in Defra research project SP0547) to develop a programme of work to tackle diffuse soil pollution (2008). Identify priorities, responsibilities and resources required to take this work forward (2008/09). Take forward the work programme for minimising diffuse soil pollution (2009 onwards).
- Complete research on the role that rural land use can play in reducing flood risk at the local and catchment scales (2008).

Questions

Q4.1 Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?

Q4.2 Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success (see paragraph [4.27](#)).

Q4.3 Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?

Q4.4 Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.

Box 7: Key elements of proposed activity within the sustainable soil management in the agriculture and forestry sector priority work area

Cross-compliance: Defra will need to consider whether current cross-compliance standards deliver effectively and proportionately good soil management across England's farmed land and consider how to optimise the delivery of soil related ecosystem services so that administrative burdens are kept to a minimum.

Environmental Stewardship: Defra will complete the review of ES and will need to ensure that ES, along with cross-compliance, optimises the delivery of soils related ecosystem services.

Climate change: Defra is working with stakeholders, through the Rural Climate Change Forum, to help the agriculture sector reduce its emissions. Defra will explore the impacts of climate change on soils and consider the implications for soils guidance.

Protection of water quality: Defra will continue to prepare for implementation of the Water Framework Directive.

Nutrient management: Defra will continue to optimise the use of nutrients to help to deliver environmental outcomes for air, water, soil, climate change and biodiversity.

Forestry: The Forestry Commission will publish revised Forests and Soil Conservation Guidelines reflecting recent changes in policy and knowledge.

Flood risk management: Defra and the Environment Agency will complete ongoing projects under the Making Space for Water programme. The EA will take soil and land management issues into account when making decisions on their work on flood risk management (through River Basin Management Plans and Catchment Flood Management Plans) and to work with farmers to improve soil management on farms to reduce localised flooding.

Air quality: Defra will consider how best to improve our understanding of the impacts of air pollutants on ecosystems, including soil communities, and how best to include consideration of these impacts as part of future revisions of the Gothenburg Protocol.

Diffuse soil pollution: Defra and the EA are assessing the policy implications of research on diffuse soil pollution and will develop a policy response.

Reducing farming's environmental footprint: Defra will continue to look at ways of benchmarking the environmental impact of farming and give guidance on good and best practices that farmers could use to improve their performances. Defra will continue to take forward the revision and publication of a new integrated Code of Good Agricultural Practice.

Chapter 5: Priority area 2: Halting the decline of soil carbon

Background

- 5.1. Soils are a major reservoir of carbon. As discussed in Chapter 2 there is some evidence to suggest that levels of carbon are declining in agricultural soils. This has implications for climate change (CO₂ emissions and reduced resilience to climatic changes) as well as the sustainable management of soils. Recent studies have shown that a small change in total organic carbon content can have an effect on soil physical properties and functions. The small increase in total organic carbon content resulting from using nitrogen fertiliser for many years was shown to considerably decrease the energy required for tillage⁷⁸. A similar trend for aggregate stability and ease of water infiltration to soil has also been shown⁷⁹.
- 5.2. The key issues that need to be considered and addressed are explained below.

Understanding the trends in respect of soil carbon and the causes of any loss

- 5.3. The extent of any loss, the mechanism for this loss, as well as that for increasing carbon levels in soils, is complex and still not fully understood. There is also a potential feedback mechanism by which climate change, through changes in temperature and soil moisture, may itself speed up the decomposition of organic matter, reducing the amount of carbon in the soil and increasing emissions to the atmosphere. This may be counteracted by the higher uptake of carbon dioxide by plants, as they grow faster in warmer conditions and store carbon as biomass.

Degradation of peat soils

- 5.4. In addition to the carbon losses from agriculturally managed soils there is also evidence to show that upland organic soils (peat) are being degraded and losing large amounts of carbon. For example, the amount of dissolved organic carbon (DOC) in water is increasing in the uplands due to losses from peat soils. Since 1988, there has been, on average, a 91% increase in DOC concentrations of UK lakes and streams in the Acid Waters Monitoring Network⁸⁰. Removal of colour from water represents one of the major operational costs of any treatment plant⁸¹ and can run into millions of pounds per annum. United Utilities are restoring approximately 6,000 hectares of peatland as part of their Sustainable Catchment Management Programme (SCaMP)⁸². They anticipate saving between £1.2 and £2.4 million per year in avoided water treatment costs.⁸³

⁷⁸ Watts et al. (2006): The role of clay, organic carbon and long-term management on mouldboard plough draught measured on the Broadbalk wheat experiment at Rothamsted. *Soil Use and Management* **22**, 334-341.

⁷⁹ Blair et al. (2006): Long-term management impacts on soil C, N and physical fertility. Part 1: Broadbalk experiment. *Soil and Tillage Research* **91**, 30-38.

⁸⁰ Evans, C. D., Monteith, D. T. & Copper, D. (2005): Long-term increase in dissolved organic carbon: observations, possible causes and environmental impacts. *Environ. Pollut.* **137**, 55-71.

⁸¹ <http://www.uk-adapt.org.uk/find/index.html?action=project&id=67>

⁸² <http://www.unitedutilities.com/?OBH=5056>

⁸³ A land fit for the future - David Miliband's speech to the Campaign to Protect Rural England Conference, 9 March 2007.

5.5. When in pristine condition, active peat bogs can accumulate up to 0.7 tonnes of carbon per hectare per annum.⁸⁴ Studies indicate that most blanket peat development began 5000-6000 years ago and on average the depth of UK peat is 0.5-3 metres, though depths in excess of 5 metres are not unusual. There is approximately 215,000 hectares of blanket peat soil in England, though significant proportions no longer support blanket bog vegetation. Additionally England has 500 hectares of lowland raised bog, down from 37,000 hectares at the start of the nineteenth century.⁸⁵ Even when they are not actively accumulating carbon peat bogs are an important store of carbon. However, these habitats can become a source of carbon when degraded and climate change may increase the rate of degradation. Losses of carbon from peats can occur in various forms, including as DOC, eroded particulates and gaseous CO₂ or methane.

Developing good agricultural practices to protect soil organic matter

5.6. Although some work has been done on identifying good agricultural practice in the development of CAP cross-compliance conditions which included the Good Agricultural and Environmental Condition measure to maintain levels of SOM (soil organic matter), in the light of a clearer need to respond to climate change it is necessary to review these requirements as well as consider further what amounts to best practice and how to incentivise this.

Progress to date

5.7. Whilst soil carbon did not feature significantly within the First Soil Action Plan there was a commitment to implement CAP cross-compliance conditions which included the Good Agricultural and Environmental Condition measure to maintain levels of SOM (soil organic matter) (Action 1), and to develop a headline indicator on SOM for the Sustainable Farming and Food Strategy (Action 11). Good progress has been made against both of these commitments (see paragraphs 4.9-4.10 and 5.13 respectively). As well as the introduction of Cross-compliance standards, work has also been going on beyond that set out in the Action Plan to consider the impacts of soil carbon loss on climate change and to develop a more robust evidence base. Additionally a project has been put in place to demonstrate to farmers practices that can reduce the loss of SOM (see paragraph 5.18).

Objectives

5.8. There are three key areas to be addressed 1) improving our understanding of the mechanisms driving losses and gains and how these can be influenced, 2) protecting existing carbon stocks (i.e. reducing the loss of carbon), and 3) determining what can be done to bring low carbon soils back up to a more optimal level of carbon.

5.9. This work area will particularly address the following objectives:

- **Reduce the rate of soil organic matter decline and protect habitats based on organic soils, such as peat bogs, to maintain our carbon stores (to mitigate**

⁸⁴ Holden et al (2007): Vulnerability of organic soils. See Defra Science website pages - Defra Project SP0532.

⁸⁵ UK Biodiversity Group Tranche 2 Action Plans - Volume VI: Terrestrial and freshwater species and habitats (October 1999, Tranche 2, Vol VI).

climate change) and soil quality – by drawing together all of the current activity on soil carbon and considering what further activity is required to protect and enhance existing carbon stocks. To deliver or contribute towards our:

- Sustainable Farming and Food Strategy target “to halt the decline in soil organic matter in vulnerable agricultural soils by 2025, whilst maintaining, as a minimum, the soil organic matter of other agricultural soils, taking into account the impacts of climate change”
- Public Service Agreement target⁸⁶ “to ensure that 95% of the area in England designated as Sites of Special Scientific Interest is in favourable or recovering condition by 2010”
- **Ensure that measures for the protection of soil functions in respect of agricultural and forest soils are effective, targeted and proportionate, take into account future pressures including our changing climate and minimise adverse impacts on air, water, biodiversity and greenhouse gas emissions** – by reducing the losses of CO₂ to the atmosphere from soil and by ensuring that soils are more resilient to climatic changes and erosion due to beneficial effects of soil organic matter

Ongoing action and areas for development

5.10. The Government is already involved in a range of direct and indirect activities to protect and enhance soil carbon. These have not been fully coordinated in the past. This Strategy will draw together all of these strands and will consider what further activity is required to protect existing carbon stocks. As part of this a new **policy project on protecting and enhancing peat soils will be developed** (see paragraph 5.14).

UK Climate Change Programme 2006

5.11. This sets out Government policies and priorities for action in the UK and internationally to tackle climate change. It recognises the measures being undertaken to conserve soil carbon under other policy levers and that more measures may be required in the future. It commits Government to **commission further work on the cause of soil carbon decline** and to host a conference to address the state of our knowledge of the issue and what could be done to address it (see paragraph 5.24). It also contains a commitment to **examine the scope and feasibility of a market based mechanism**, compatible with the Government’s aspirations for the EU Emissions Trading Scheme and UK Emissions Trading Scheme, to facilitate trading of greenhouse gas reductions from agriculture and other land management sectors. A study has been carried out to assess the data needs and the feasibility of – and possible options for – such a mechanism. The study also included an initial cost benefit analysis of possible options. The report will be published in early 2008 and the implications for future policy will be considered.

5.12. More broadly, Defra is continuing to work on the evidence base, through our R&D programme on Agriculture and Climate Change, to build understanding about the impacts of climate change on agriculture and the range of mitigation measures needed. **We will also continue to work with the Rural Climate**

⁸⁶ Defra’s Public Service Agreement 2005-2008.

Change Forum to raise awareness of climate change among farmers and land managers.

Sustainable Farming and Food Strategy

5.13. One of the Strategy's headline indicators on the better use of natural resources is on soil organic matter in agricultural topsoils⁸⁷. The target for this indicator is to "halt the decline of soil organic matter caused by agricultural practices in vulnerable soils by 2025, whilst maintaining, as a minimum, the soil organic matter of other agricultural soils, taking into account the impacts of climate change". It is expected that progress has been made towards achieving this (see priority work area 1, Chapter 4) but **further monitoring is required to determine the effectiveness of our actions** (planned to start in 2008). **We will then assess what further action will be required. Natural England is examining the role that land managers can play as 'carbon managers'**, by initially carrying out a review of what is known already in terms of science and evidence as well as identifying the gaps in knowledge that need to be researched further.

Peat Project

5.14. A new policy project on protecting and enhancing peat soils **will coordinate activity within Defra, Welsh Assembly Government, Environment Agency, Forestry Commission and Natural England, and with stakeholders, in order to use appropriate policy levers and management options for the protection, restoration and adaptation of peat soils and habitats.** The project recognises the value of peat soils as a significant carbon store and the sensitivity of peat to degradation. Degraded peat can release carbon into the atmosphere and water, and thus contribute to climate change and water discolouration; lead to a loss of biodiversity; and speed up the flow of water across the landscape, potentially increasing the risk of flooding downstream. The Project takes a whole ecosystem approach (see paragraph 3.15). Based on an assessment of the location and quality of peat soils, the project will compile and build an evidence base from which to identify further research and policy needs. The project will contribute to a range of outcomes and targets including the SFFS target for SOM decline (see paragraph 5.13), the target for Sites of Specific Scientific Interest (see paragraph 5.17) and the UK BAP target for reduced horticultural peat usage (see paragraph 5.16) as well as improved water quality. The project has been identified as a priority action in the Ecosystem Approach Action Plan (see paragraph 3.15).

UK Biodiversity Action Plan

5.15. The UK Biodiversity Action Plan (UK BAP) was published in 1994 as part of the UK response to the Convention on Biological Diversity signed in Rio de Janeiro in 1992. The UK BAP helps coordinate and drive conservation work at national and local levels through identifying priorities for action and setting biological targets for the recovery of species and habitats. In addition, the England Biodiversity Strategy, Working with the Grain of Nature, published in 2002, sets out a programme to ensure integration of biodiversity into policy making and practice. A full report on progress was published in 2006, including proposals for meeting the challenges of the next four years. Blanket bog (peat)

⁸⁷ http://statistics.defra.gov.uk/esg/indicators/h5_data.htm

and lowland raised bog (peat) are both priority habitats, the action plans for which set out requirements to **maintain the current extent and distribution of these habitats and to improve the condition of degraded bogs by 2015.**

5.16. Peat is a major constituent of most horticultural growing media. It has been estimated that the horticulture industry accounts for about one-third (much of it imported) of all the peat used as a growing medium in the UK (in total the UK uses 3.4 million cubic metres of peat per annum), with the remaining two-thirds used almost entirely by amateur gardeners. Until a suitable viable alternative is developed then peat will still be required by the horticultural industry. Under the UK Biodiversity Action Plan (Lowland Raised Bog Habitat), the Government is committed to undertake and promote research and development into sustainable alternatives to peat and provide advice on the development and marketing of peat alternatives. The aim of the plan is for 90% of the total market requirements to be peat free by 2010. As part of the peat project (see paragraph 5.14) **Defra is considering what is already known about peat alternatives, what factors would improve confidence in existing alternatives, and what can be done to increase the rate of development of alternatives, as well as addressing public awareness of the need to reduce peat usage.**

Site of Special Scientific Interest Public Service Agreement target

5.17. Extensive areas of blanket bog and lowland raised bog are also given legal protection by designation as a conservation site, e.g. Site of Special Scientific Interest (SSSI). **Defra has a Public Service Agreement (PSA)⁸⁸ target to bring 95% by area of nationally important wildlife sites (SSSIs) into favourable or unfavourable recovering condition by 2010.** A considerable proportion of peat bogs are designated as SSSIs and currently around two thirds of this area meets the target; improving the condition of the remainder is a priority.

Soil organic matter management in priority catchments

5.18. This Defra and Natural England project aims **to establish whether within existing farm businesses, profitable changes in agricultural management can be encouraged which result in a reversal or halting of the loss of soil organic matter (SOM).** It is being delivered in association with the English Catchment Sensitive Farming Delivery Initiative in 8 priority catchments and runs until March 2008. The project will describe the impacts and limitations of SOM management techniques on farm businesses. It will pilot a system of SOM management advice to farmers and monitor changes in attitudes and activities of farmers. **The project also aims to test and demonstrate 'Active Carbon': an indicator that can be used to determine the direction of change of SOM content.** There is a growing body of evidence that the active fraction of SOM is more important to soil properties than total SOM.⁸⁹ The project will also examine SOM related advice provision in the uplands and determine the best methods to deliver this.

⁸⁸ Defra's Public Service Agreement 2005-2008.

⁸⁹ Loveland et al (2000): Critical levels of soil organic matter. See Defra Science website pages - Defra Project SP0306.

Environmental Stewardship

5.19. As well as the Entry Level Stewardship and Higher Level Stewardship soil options considered in priority work area 1 (see paragraph 4.11) there are also options to protect habitats that store carbon. Around 230,000 hectares of peat bog are already managed under agri-environment schemes (Countryside Stewardship, Environmentally Sensitive Areas and Environmental Stewardship agreements). For Less Favoured Areas there are ELS options for enclosed rough-grazing and moorland rough grazing where farmers are required to protect permanently waterlogged wetlands, including peat bogs and other mires, cannot install any new land drainage or modify any existing drainage and where they cannot remove any peat or sediment from drainage channels. Under HLS there are options to maintain and protect peat based habitats including grip blocking and re-wetting of moorland. The uptake of these options will be considered in **the review of ES** (see paragraph 4.12), with particular reference to climate change mitigation options.

5.20. As announced in December 2006 upland support will be fully integrated in Environmental Stewardship from 2010 and Defra is minded to do this through a specific uplands strand of the ELS scheme. With Natural England and other stakeholders, **Defra is developing the successor to the Hill Farm Allowance (likely to be Uplands ELS) as part of the ES Review of Progress.**

Heather and Grass Burning

5.21. The revised Heather and Grass Burning Code and Regulations apply from 1 October 2007. The voluntary Code of Good Practice sets out how to conduct controlled burning safely and sustainably, among other things minimising the possibility of causing soil erosion and loss of peat-based carbon. The revised Regulations introduce new provisions to outlaw irresponsible burning (as practiced by a small minority of burners in the past) which causes a significant risk of soil exposure or erosion. **Defra and Natural England will work with the industry to encourage good practice through the promotion of the Code and enforcement of the Regulations.**

Energy – Biomass and biofuels

5.22. The Government's Biomass Strategy⁹⁰, published in May 2007 alongside the Energy White Paper, brings together current UK Government policies on biomass for energy, transport and industry, and recognises the importance of fuels sourced from biomass in tackling climate change. Delivery of the Strategy will require a major expansion of biomass use and sustainable supply. The Strategy acknowledges that increasing the supply of biomass will have implications for land use, biodiversity, landscape and a range of other environmental factors, including soil carbon. This is particularly the case when previously non-arable land is brought into biomass/biofuel production. **The Government (Defra, the Department for Business Enterprise and Regulatory Reform and the Department for Transport) will seek to deliver an expansion of biomass production in a way which is consistent with an enhanced, sustainable approach to land management.** Defra are also leading an interdepartmental

⁹⁰ <http://www.defra.gov.uk/environment/climatechange/uk/energy/renewablefuel/index.htm>

project to **review evidence and develop and co-ordinate a consolidated UK international biofuels strategy.**

Planning policy

5.23. The new Planning Policy Statement on Climate Change⁹¹ was published in December 2007. It sets out how spatial planning, whilst providing for the new homes, jobs and infrastructure needed by communities, should contribute to lower carbon emissions and greater resilience to inevitable climate changes. It requires climate change to be a key and integrating theme of Regional Spatial Strategies and includes an expectation that regional planning bodies should recognise the potential of, and encourage, those land uses and land management practices that help secure carbon sinks.

Evidence base

5.24. In May 2006 Defra held a workshop to establish where the significant gaps in our knowledge were, how these can best be addressed and by whom, and to determine whether there was sufficient available evidence to justify a specific soil carbon accumulation or retention policy in its own right. The workshop identified that current policies (e.g. cross-compliance, Environmental Stewardship and Catchment Sensitive Farming) were adequate given the evidence base. Further evidence was required on:

- the main drivers of soil organic carbon (SOC) loss and more particularly on impacts of land use and management practices;
- the major chemical, physical and biological mechanisms responsible for SOC loss;
- the relative importance of the pathways and ultimate fate of lost SOC through soil, water or air; and
- providing greater certainty in the contribution of upland peat sites to SOC loss, taking account of total fluxes and stocks and the importance of different transport and fate mechanisms.

A technical workshop in October 2006 brought experts together to determine which parts of these needs could be answered using existing data and to refine these identified areas in need of further work to specific policy-driven R&D which would be commissioned in 2007/08.

5.25. The key recommendations for future research in soil carbon are:

- Improved sharing and integration of data to enable us to obtain a better idea of the state of our carbon stocks and the processes that affect them, to help interpret the state and to produce better informed models to help us predict processes and state in the future.
- Better understanding of processes involved in carbon movement/retention in soil (including mitigating emissions of pertinent trace gases).
- Better estimates/data on carbon flux (an accurate means of assessing carbon flux is likely to produce more sensitive measurements than the alternative of estimating differences in mass from measuring stock). It is likely that we will also require stock measurements.
- To ensure that soils carbon research is coordinated across the key UK funders and users of soils research.

⁹¹ <http://www.communities.gov.uk/publications/planningandbuilding/ppscclimatechange>

5.26. To meet these requirements Defra intends to take forward two key areas of work. Firstly an initial project to collate data on fluxes and stocks of soil carbon to develop a model to test changes in carbon state under different scenarios to help us improve our understanding of the different processes. Then, to commission further research in collaboration with other UK funders to fill the identified gaps in order to understand these processes better.

5.27. Work is now being undertaken **to develop the R&D programme and to put in place the first project** referred to above.

Support from other priority work areas

5.28. This priority work area is also supported by activity under priority work areas 1, 3 and 4. This is summarised in Box 8.

Box 8: Support for the halting the decline of soil carbon priority work area provided by the other priority work areas

Cross-compliance: GAEC standard on organic matter decline and specific guidance on the management and protection of peat soils (see paragraph 4.9).

Protection of water quality: promoting good soil management (including protecting and enhancing SOM) to reduce diffuse water pollution from agriculture (see paragraphs 4.15-4.16).

Air quality: objectives to protect vegetation and ecosystems (including peat bogs) from degradation caused by the deposition of pollutants (see paragraphs 4.21-4.23).

Land use: consideration being given to the use of land for carbon storage (see paragraph 6.22).

Quality compost protocol: having a quality standard for compost will encourage its use as a peat alternative in horticulture as well as encouraging the recycling of organic materials to land to protect and enhance SOM (see paragraph 7.9).

Success

5.29. Successful delivery of this work area would mean that we have an improved understanding of what drives soil carbon loss, the extent of this loss, and what constitutes best practice by farmers and land managers to reduce soil carbon loss and protect stores. It will also mean that appropriate policy responses are developed and measures put in place to ensure that we achieve our target for halting the decline of soil carbon.

Key next steps

5.30. The following actions have been identified. They are the proposed next steps only and the achievement of these actions will not on their own lead to the delivery of this priority work area's objectives and success criteria:

- Complete the project assessing how best to encourage improved management of organic matter/carbon in soils by land managers (to be completed by March 2008) (See paragraph 5.18). The ability to monitor changes in organic matter levels and techniques to conserve or enhance this will be evaluated as part of the project (during 2008) using sensitive analytical techniques. Facilitate the roll out of the guidance developed during the project and develop further options to achieve our Sustainable Farming and Food Strategy target as appropriate (2008/09).
- Put in place the identified research and develop the coordinated research programme to improve the understanding of the processes driving carbon loss and their mitigation (2008 onwards).
- Ensure that monitoring arrangements are in place to be able to assess the extent of continuing carbon loss (2008).
- Report against Sustainable Farming and Food Strategy headline indicator “Halt the decline of soil organic matter caused by agricultural practices in vulnerable soils by 2025, whilst maintaining, as a minimum, the soil organic matter of other agricultural soils, taking into account the impacts of climate change” during 2010.
- Take forward the first phase of the peat project (which it is planned to complete by December 2009).

Questions

-
- Q5.1 Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?**
- Q5.2 Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success (see paragraph 5.29).**
- Q5.3 Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?**
- Q5.4 Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.**
-

Box 9: Key elements of proposed activity within the halting the decline of soil carbon priority work area

UK Climate Change Programme: Defra will continue to commission further work on the cause of soil carbon decline; and examine the scope and feasibility of potential market based mechanisms to facilitate trading of greenhouse gas reductions from agriculture and other land management sectors. Defra will also continue to work with the Rural Climate Change Forum to raise awareness of climate.

Sustainable Farming and Food Strategy: Defra will undertake monitoring to determine the effectiveness of our actions to halt the decline of Soil Organic Matter and assess what further action is required. Natural England will examine the role of land managers as carbon managers.

Peat policy project: Defra will develop a programme of work to facilitate and coordinate activity within Defra, Welsh Assembly Government, Environment Agency, Forestry Commission and Natural England, and with stakeholders, to protect and enhance peat soils using appropriate policy levers and management options.

UK Biodiversity Action Plan: Defra will consider what is already known about peat alternatives, what factors would improve confidence in existing alternatives, and what can be done to increase the rate of development of alternatives, as well as addressing public awareness of the need to reduce peat usage.

Site of Special Scientific Interest target: Defra and Natural England will continue to bring SSSI peat bogs into favourable or unfavourable recovering condition by 2010.

Soil organic matter management in priority catchments: Defra and Natural England will establish whether agricultural management practices can be encouraged which result in a reversal or halting the loss of soil organic matter and test and demonstrate 'Active Carbon': an indicator that can be used to determine the direction of change of Soil Organic Matter content.

Environmental Stewardship: Defra will undertake a review of Environmental Stewardship – including the development of the successor to the Hill Farm Allowance (likely to be Uplands Entry Level Stewardship) with Natural England and other stakeholders; encourage the uptake of options to protect carbon stocks (e.g. peat bogs) and address climate change more broadly.

Heather and Grass Burning: Defra and Natural England will work with the industry to encourage good practice through the promotion of the Code and will monitor emerging evidence on the impacts of burning on peat soils and take action as required.

Evidence base: Defra will develop a coordinated R&D programme on soil carbon and put in place research.

Energy – Biomass and biofuels: The Government will seek to deliver an expansion of biomass production in a way which is consistent with an enhanced, sustainable approach to land management. Defra will also lead an interdepartmental project to review evidence and develop and co-ordinate a consolidated UK international biofuels strategy.

Chapter 6: Priority area 3: Sustainable soil management in the built environment

Background

- 6.1. In this Strategy, the “built environment” means any land where development and construction (infrastructure, commercial and residential) has occurred or is planned. Soils in the built environment include soils in gardens, parks, derelict/brownfield land and road verges, and are a mixture of natural (in situ), imported and manufactured⁹² soils.
- 6.2. Nearly 81% of the population of England lives in urban areas⁹³ on 7.48% of the land area⁹⁴. This means that in those areas there is considerable pressure on soils and the ecosystem services they provide. However, similar pressures may affect any part of the built environment, whether in an urban area, or in an area which would be regarded as rural.
- 6.3. Activities related to the built environment, such as development and construction, can have significant impacts on soil functions. These impacts include compaction, due to the use of heavy machinery, and soil sealing⁹⁵ which both affect the capacity of soil to support biodiversity and can lead to reduced filtration of run-off and aquifer recharge as well as increased flood risk. In addition, there is an impact on good quality soil through: development on high grade agricultural land, including where good quality soil is disposed of as waste when excavated during construction and through soil being mixed with building rubble and other construction materials. Climate change is also anticipated to have some significant effects on soil in the built environment, for example through more severe climatic events such as heavy rainfall which will increase risks relating to land slippage or droughts which will increase the risk of subsidence on clay soils.
- 6.4. The key issues that we have identified as requiring further consideration are: the effect of sealing and compaction on filtration of run-off, flood risk and biodiversity; contamination of soil with construction and demolition materials during the construction process; loss of good quality soil as waste; loss of good quality agricultural land; and the effects of climate change on soil in the built environment. The paragraphs below explain why these issues are of importance.

Soil sealing

- 6.5. Many of the important ecosystem services that soil provides are linked to its access to air and moisture. Development that leads to sealing of the soil surface can therefore limit the services that the soil can provide and affect the hydrology of urban areas⁹⁶, increasing rainfall run-off and urban flood risk and reducing

⁹² Manufactured topsoil is increasingly being used where there are local shortages of good quality topsoil or surpluses of subsoil or other materials used in the manufacture of topsoil, i.e. minerals (sand, silt and clay) and organic materials (e.g. compost).

⁹³ 2001 Population census, ONS, produced by Rural Statistics Unit, Defra, York.

⁹⁴ The definition of an urban area used here is an extent of land of at least 20 hectares with a population of 10,000 or more residents at the time of the 2001 census.

⁹⁵ Soil sealing is the covering of the soil surface with impermeable material, e.g. concrete.

⁹⁶ Royal Commission on Environmental Pollution (2007): Twenty-sixth report: The Urban Environment.

aquifer recharge (see paragraphs 2.34-2.42). However, soil sealing is often necessary for development that is socially and economically, as well as environmentally, beneficial, and sealing can also be necessary during the course of brownfield as well as greenfield development. The planning system already provides a mechanism for these environmental concerns to be taken into account but it is necessary to ensure its effectiveness. Details of how the planning system takes account of soil is given below at paragraph 6.17. Details of the use of sustainable urban drainage systems to reduce the impact of soil sealing are given below at paragraphs 6.25-6.26.

6.6. The importance of protecting our natural environment within urban areas was the subject of the Royal Commission on Environmental Pollution's (RCEP) twenty-sixth report on the urban environment. It states that the natural environment of towns and cities is under-recognised and undervalued. Consisting of more than just parks and gardens, it includes air, soil and water and a diverse range of areas and habitats, including little valued areas like brownfield sites and transport corridors. All these areas can make an important contribution to urban ecosystems and provide important ecological services in terms of biodiversity, climate, water and flood management. The RCEP has stated that it would like to see more use of flexible green infrastructure in preference to an over-reliance on the expensive, hard engineering approaches of the past and recommends that planning policy recognises and protects the role that urban ecosystems can play in improving towns and cities. It also recommends that local planning authorities minimise the use of hard-standing, requiring the use of permeable surfaces for paving and car parking.⁹⁷

Land use change

6.7. National policy in England is for planning authorities to make effective use of land, with a national target of at least 60% of new housing to be provided on previously developed land. By 2005, 5.7% of England was developed; this includes land identified in the Generalised Land Use Database as used for domestic buildings, non-domestic buildings, road, rail, footpaths, and other, and excludes domestic gardens⁹⁸.

6.8. In England, between 2001 and 2003, around 5,860 hectares per year changed from previously undeveloped land to developed land⁹⁹. This represents an addition of around 0.5% to the total developed land area and is a lower rate of change than in the period 1995-97. This reflects various factors including more new housing being built on previously developed land, in excess of the 60% target set by Government, and the increased density of housing developments in accordance with Government policy.

6.9. The policy of Best and Most Versatile Land (BMV) is used to protect agricultural land from development. It advocates that where significant

⁹⁷ Royal Commission on Environmental Pollution (2007): Twenty-sixth report: The Urban Environment.

⁹⁸ DCLG (2007): Generalised land use database statistics for England 2005. The figure is lower than the figure for 'urban areas' generally, because the figure for urban areas includes green space and other categories.

⁹⁹ The term "developed land" is used in respect of an extent of land of at least 20 hectares with a population of 1000 or more.

development of agricultural land is unavoidable, poorer quality land should be used in preference to that of higher quality, except where this would be inconsistent with other sustainability considerations. It employs a land classification system known as Agricultural Land Classification (see Annex C). There are increasing pressures on our agricultural land caused by: reduced agricultural productivity in other countries which are affected by drought and desertification, increasing demand for biofuels, population growth, the increasing demand for sustainable locally produced food, as well as the longer term risks relating to climate change including soil degradation and of loss of agricultural land through sea level rise. In the light of this, it is important that consideration is given to the weight that needs to be placed on protecting good quality soils. Projects such as the Foresight project on land-use (see paragraph 6.22) will contribute towards this objective.

Construction

6.10. The construction sector has the largest impact on soil within the built environment. Evidence gathered over the last three years¹⁰⁰ shows that soils are often only a last minute consideration when planning and landscaping a development. This means that good quality soil may end up being contaminated with rubble or other construction materials and disposed of as waste or compacted during storage or by trafficking with machinery after spreading. The evidence gathered suggests there are significant opportunities for improvement¹⁰¹ if consideration is given earlier in the construction process. For example, this can be achieved through the sustainable reuse of good quality soils¹⁰² which are surplus to requirements, following urban development and road building, particularly in areas where there is a shortage of good quality topsoil, e.g. South East England¹⁰³.

6.11. In 2005 over 4 million tonnes of soil were recovered from construction, demolition and excavation waste¹⁰⁴. Some of this screened soil is sold as an alternative to natural topsoil for use in landscaping developments. However, it is often a mixture of topsoil, subsoil, clay and numerous fragments of building waste materials – brick, concrete, mortar, ash, clinker and, to a lesser extent, glass, metal, wood and plastic. In terms of its physical and chemical properties, the material may often be extremely alkaline, saline, infertile, and contain elevated levels of chemical contaminants (heavy metals and hydrocarbons) and ‘sharps’, e.g. shards of glass or ceramics¹⁰⁵.

¹⁰⁰ <http://www.defra.gov.uk/environment/land/soil/built-environ/construction.htm>

¹⁰¹ Reeves et al (2007): Developing a code of practice for the sustainable use and management of soils on construction sites. Defra project Soil 126.

¹⁰² Soil is typically removed from the land surface prior to construction. It should be stored on site during development and protected from contamination and compaction so that it can be reused on site or protected in another way. (See WRAP (2007) Is topsoil costing you the earth?).

¹⁰³ Reeve et al (2006): Fate of surplus soil at development sites. See Defra Science website pages - Defra Project SP0701.

¹⁰⁴ DCLG (2007): Survey of arisings and use of alternatives to primary aggregates in England, 2005. Construction, Demolition and Excavation Waste.

¹⁰⁵ British Association of Landscape Industries (2006): Topsoil. Landscape News. Summer 2006, p16-23.

6.12. Finding soils in built environment gardens and green spaces containing building rubble or other physical contaminants is all too common. A survey of 10 urban centres in England, Scotland and Wales by the British Geological Survey found visible signs of contamination in over 50% of the samples¹⁰⁶.

6.13. In 2002 there were 345 recorded water pollution incidents in England and Wales involving the unauthorised disposal or inadequate containment of soil during construction.¹⁰⁷ The annual cost of dealing with problems related to sediment in the urban drainage system is in the order of £50-60 million and individual companies have been fined up to £18,000 as a result of water pollution incidents in recent years.

Climate change

6.14. Climate change will have implications for soils in the built environment. As a result of likely increases in winter rainfall, particularly the magnitude and frequency of intense events, as well as increases in summer temperatures and the frequency of drought. Such conditions are likely to have negative impacts on land stability and give rise to landslips, increase subsidence and cause problems with drainage and flooding. Higher temperatures will encourage changes in the nutrient requirements and processing of urban soils and may exacerbate chemical attack on building foundations. The behaviour of soils, particularly those containing clay, under different rainfall patterns will require changes in their management and the need to repair and underpin foundations.¹⁰⁸ The Association of British Insurers estimate that the annual future costs of subsidence claims could increase due to climate change from the current £300 million - £600 million, to £600 million - £1,200 million by 2050.¹⁰⁹

Progress to date

6.15. Good progress has been made under the First Soil Action Plan to begin to improve the sustainable management of soil in the built environment. This includes: clear reference to soils in PPS statements, revision of the British Standard for topsoil, development of an evidence base (attitudes towards soil covering and the impact of construction practices), engagement with stakeholders and initial steps by Defra to prepare improved information for planners and the construction industry.

Objectives

6.16. We will build on our progress in these areas to achieve our objectives. This work area will particularly address the following objective:

- **Ensure that, in accordance with the principle of sustainable development, the construction industry and planning authorities take account of the need to protect soil resources, and ensure soils are able to fulfil as many as possible of their functions, especially storing, transporting and filtering water.** The necessary requirements have been incorporated into national

¹⁰⁶ British Geological Survey (2005): Geochemical Survey of Urban Environments.

¹⁰⁷ EA (2004): The state of soils in England and Wales.

¹⁰⁸ Bradley et al (2005): Impacts of climate change on soil functions. See Defra Science website pages - Defra project SP0538.

¹⁰⁹ Association of British Insurers (2004): A changing climate for insurance.

planning policy statements. We will help regional and local planning authorities implement those policies effectively. We will provide information and tools to allow impacts on soils to be assessed, recognising the range of ecosystem services that soils provide, and promote design which incorporates sustainable urban drainage; and guidance and training on best practice for the construction sector. The following paragraphs explain what we will do in more detail.

Ongoing action and areas for development

Planning policy

6.17. The planning system provides strategic direction for the use of land, and control over the details of individual developments. An extensive body of legislation establishes the powers and duties given to various agencies and the procedures involved. Central Government provides a broad and directional policy framework. The role of the planning system in relation to soils is as described at Annex C.

6.18. The Government continues to put emphasis on considering in the planning system the natural qualities of soil. For example, in December 2007 the Government published a new Planning Policy Statement (PPS) on Climate Change¹¹⁰, which will form a supplement to PPS1. This draft PPS requires Regional Planning Bodies, when drawing up Regional Spatial Strategies, to recognise the potential of and encourage those land management practices that help secure carbon sinks, including non-living reservoirs such as soil. Similarly, PPS 7 advises planning authorities, when preparing Local Development Documents and determining planning applications, to take account of the need to protect natural resources, including soil quality and best and most versatile agricultural land.

6.19. The Planning White Paper, published in May 2007, proposes reforms on how decisions are taken on nationally significant infrastructure projects – including energy, waste, waste-water and transport – responding to the challenges of economic globalisation and climate change. It also proposes further reforms to the Town and Country Planning system, building on the recent improvements to make it more efficient and more responsive.

6.20. Current planning policies are expected to provide a strong framework for consideration to be given to soil issues. **Defra will continue to work with Communities and Local Government (CLG) to ensure effective implementation of these policies; and in particular will consider in liaison with CLG what soil information is required to take decisions at the local level and the best mechanisms for making this available.**

Strategic Environmental Assessment and Environmental Impact Assessment

6.21. The European Directives on Strategic Environmental Assessment of plans and programmes and Environmental Impact Assessment of projects, described at Annex C, both require impacts on soils to be included in assessments. There is evidence to suggest that many of those responsible for undertaking these

¹¹⁰ <http://www.communities.gov.uk/publications/planningandbuilding/ppsclimatechange>

assessments find it difficult to take account of the potential impacts on soil. **Defra will provide guidance about the soil information needed to undertake these assessments at regional, local and site level, and information to assist planners and developers to consider the impact on soil functions. It will consider the best mechanisms for making this soils data available.**

Land use

6.22. Defra is leading a cross-Government Land Use Project, which is concerned with taking a holistic, long-term view of land use in England - looking ahead to 2050 and beyond - and identifying the policy tools and levers needed to optimise our use and management of land. The project is underpinned by the concept of land as a finite resource which is under increasing pressure from a complex range of factors, including climate change and population growth. It will have two main elements: a study by Foresight which will analyse future land use challenges through looking at pressures and trends and developing scenarios and models; and more practically focused work concerned with learning lessons from the wide range of initiatives already underway which are seeking to achieve multiple benefits from land - social, environmental, and economic. The consideration of soil issues, including carbon stores, will be a significant factor in the project.

British Standard for topsoil

6.23. Research undertaken to develop the Soil Action Plan programme of work in the built environment highlighted that one of the most influential documents as to the consideration of soils during construction was the British Standard for topsoil¹¹¹ (BS3882: 1994)¹¹². However, there was some dissatisfaction with the standard and concerns that it was being widely misapplied, particularly in the over-specification of premium grade topsoil. There was a need to consider how the topsoil standard could better promote the sustainable use of topsoil within development projects. In 2006 Defra set up an expert working group to review the standard. With a consensus view that the standard required revision the group drafted a revised standard. Following public consultation the revised standard (BS3882: 2007) was published in November 2007. **We will continue to ensure that the construction industry and others involved in this sector are made aware of the changes.** We will also work with industry and the Environment Agency to **determine if the revised standard could form the basis of a quality protocol designed to remove clean surplus soil from waste management controls** (see paragraph 7.9 and Annex C).

Code of practice for sustainable use of soils on construction sites

6.24. The revised British Standard alone will not address all of the issues of sustainable soil use on construction sites. Whilst the Standard can define the desirable properties of soil and provide some guidelines on how it should be used, explaining the implications for soil of the breadth of construction site activities is well beyond its scope. Therefore it needs to be supplemented with best practice guidance. Much of the information needed to develop this guidance is available within other sectors, but it needs to be drawn together and tailored to the particular situations that occur on construction sites. Work has begun to

¹¹¹ BSI (1994) BS 3882: 1994 Specification for Topsoil. British Standards Institute, London.

¹¹² Swann et al (2005): Soils in the built environment - A strategy for the construction sector (report to Defra).

develop a joint Defra/Department for Business, Enterprise and Regulatory Reform (BERR) code of practice for soil use on construction sites (Action 4 of the First Soil Action Plan for England). Overseen by a stakeholder steering group (including representatives from the construction, landscaping and civil engineering industries) **a draft code of practice will be put out for consultation** in early 2008 with a view to final publication during 2008.

Diffuse urban water pollution

6.25. Construction and transport activities are important sources of water pollution in the urban environment, which can affect the ecology and water quality of many catchments. **Defra is reviewing the available evidence on non-agricultural sources of diffuse water pollution and will seek to develop mechanisms to tackle the causes.** These will be implemented alongside those being established to combat diffuse pollution from agriculture.

Sustainable urban drainage

6.26. The Government Strategy for flood and coastal erosion risk management in England 'Making Space for Water' identified a strong need for a holistic, joined-up, and integrated approach to deal with the problems of flooding. This is especially the case in urban areas where there is currently a complex interaction of drainage systems, and a widespread difficulty in identifying ownership of the problem. To achieve a better integration of urban drainage management, work is being undertaken, through the use of pilots, **to identify workable options to enable partnerships to deliver integrated drainage proposals, particularly in high-risk urban areas**¹¹³. This will include consideration of increased infiltration to soil in urban and suburban environments.

6.27. Sustainable urban drainage systems (SUDS) are a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques. The philosophy of SUDS is to mimic as closely as possible the natural drainage from a site before development and to treat runoff to remove pollutants. SUDS comprise a wide range of techniques, including green roofs, permeable paving, rainwater harvesting, swales, detention basins, ponds and wetlands. The use of SUDS is promoted by the planning system. Both PPS1: Delivering sustainable development and PPS25: Development and Flood Risk (supported by its Practice Guidance), require that Regional Planning Bodies and Local Planning Authorities promote the use of SUDS. **The Government's Water Strategy, published in February 2008, sets out the way forward for the use of SUDS**¹¹⁴.

Contaminated land policy

6.28. The contaminated land regime (set out in Part IIA of the Environmental Protection Act 1990) entered into force in April 2000. Part IIA created a new framework to address the historical legacy of land contamination. It focuses on the identification and remediation of land which is in such a condition by reason of contamination that it gives rise to significant harm or the significant possibility of significant harm to certain named receptors, or gives rise to pollution of controlled waters or the likelihood of such pollution. The Part IIA regime was designed and

¹¹³ <http://www.defra.gov.uk/envIRON/fcd/policy/strategy/ha2.htm>

¹¹⁴ Defra (2008): Future Water: The Government's water strategy for England.

intended to encourage voluntary remediation rather than regulatory action and to work with the established role of planning and building control in those cases where the land is scheduled for redevelopment. Planning Policy Statement 23: Planning and Pollution Control, sets out how the planning system can assist in the remediation of contaminated land through the process of development. Before granting planning permission a planning authority will need to be satisfied that the proposed development does not create or allow the continuation of unacceptable risk arising from the condition of the land in question or from adjoining land. In addition, a key objective of Planning Policy Statement 3: Housing, is that Local Planning Authorities should continue to make effective use of land by re-using land that has been previously developed. The national target is that at least 60% of new housing should be provided on previously developed land. The various agencies with a responsibility for regeneration such as English Partnerships, the regional development agencies and local authorities, all play a role in dealing with land contamination when they encounter this on sites which they seek to bring back into beneficial use.

Climate change

6.29. As part of the work looking at the interaction of climate change with soils (see paragraph 4.14) **Defra will explore the impacts of climate change on soils in the built environment.**

Success

6.30. Successful delivery of this work area would mean that planning policies are developed and decisions taken and acted on with an understanding of the potential impacts on soil functions and that soils are handled sustainably on construction sites, encouraging surplus topsoil resources to be reused or recycled where appropriate. Success will also mean that SUDS, which is already required to be included in regional and local planning policy documents, and other such examples of good practice become an integral part of the design of new development.

Key next steps

6.31. The following actions have been identified. They are the proposed next steps only and the achievement of these actions will not on their own lead to the delivery of this priority work area's objectives and success criteria:

- Develop and promote a code of best practice for soil handling on construction sites (2008).
- Work with partners to promote the new topsoil standard throughout the construction and client communities (2008).
- Work with CLG to provide better information for planners and developers.
- Evaluate impact/uptake of built environment policies/tools and determine if further action is required (2010).

Questions

- Q6.1** Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?
- Q6.2** Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success (see paragraph [6.30](#)).
- Q6.3** Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?
- Q.6.4** Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.
-

Box 10: Key elements of proposed activity within the sustainable soil management in the built environment priority work area

Planning policy: Defra will continue to work with Communities and Local Government to ensure that planning policies are implemented effectively; and in particular will consider in liaison with CLG what soil information is required to take decisions at the local level and the best mechanisms for making this available.

Strategic Environmental Assessment/Environmental Impact Assessment: Defra will seek to ensure that sufficient soil information is available for planners and developers to ensure that soil is taken into account in Strategic Environmental Assessments, sustainability appraisals and Environmental Impact Assessments.

Land use: Defra will ensure the consideration of soil issues, including valuation of carbon stores and protection of agricultural soils, in the land use debate.

British Standard for topsoil: Defra will continue to work with stakeholders to ensure that the construction industry and client community are made aware of the changes. Defra will also work with industry and the Environment Agency to determine if the revised standard could form the basis of a quality protocol designed to remove clean surplus soil from being waste management controls.

Code of practice for sustainable use of soils on construction sites: Defra and the Department for Business, Enterprise and Regulatory Reform will produce and promote a code of practice.

Diffuse urban water pollution: Defra will continue to review the available evidence on non-agricultural sources of diffuse water pollution and will seek to develop mechanisms to tackle the causes.

Sustainable urban drainage: Defra will identify options to enable partnerships to deliver integrated drainage proposals, particularly in high-risk urban areas.

Climate Change: Defra will explore the impacts of climate change on soils in the built environment.

Chapter 7: Priority area 4: Protection of soil during the recycling of organic materials to land

Background

- 7.1. Recycling of organic materials (e.g. composts, industrial wastes, manures) to soil presents a significant opportunity to maintain organic matter levels in soil. It also presents soil with a range of potential pollutants that can accumulate in the soil to levels where they become toxic and can impair the long-term functioning. There may also be diffuse pollution risks from applying organic materials to land due to their nutrient content. Moreover, it may not always be desirable to increase the organic matter content of the soil if certain habitats are being created.
- 7.2. Leaching losses and plant uptakes of heavy metals are usually small compared with the total quantities entering the soil from different sources, so they tend to slowly accumulate in topsoils over time. This has long-term implications for soil quality, including phytotoxicity to crops at high concentrations, the maintenance of soil microbial processes (e.g. nitrogen fixation, biological activity), and the transfer of zootoxic elements to the human diet from increased crop uptake or soil ingestion by grazing livestock (e.g. for cadmium and lead).¹¹⁵
- 7.3. In terms of soil quality, the key issue is one of the least well understood impacts of soil heavy metal additions which is the effect of certain metals on soil microbial processes, and how this impacts on the ecosystem services provided. Research in the mid 1990s concluded that metals, especially zinc¹¹⁶, affect soil respiration rates, the soil microbial biomass and fixation of atmospheric nitrogen. More recently, studies have shown that elevated soil zinc can affect the functional diversity of microbial communities^{117, 118}.

Progress to date

- 7.4. Whilst the protection of soil during the recycling of organic materials to land did not feature significantly within the First Soil Action Plan there were actions on minimising the pollution of soils (Actions 17-29). Research has been undertaken to identify the major past, current and future sources of soil pollutants and a programme of work to take forward the project outputs is being developed (see paragraph 4.24). Work has also been going on beyond that set out in the Action Plan to determine the available land bank for the recycling of organic materials and developing a quality protocol for compost made from source segregated organic materials (see paragraphs 7.8-7.9).

¹¹⁵ Nicholson et al (2007): Sources and impacts of past, current and future contamination of soil. See Defra Science website pages - Defra Project SP0547.

¹¹⁶ McGrath SP (1996): Effects of heavy metals from sewage sludge on soil microbes in agricultural ecosystems. In: Toxic Metals in Soil-Plant Systems, ed. SM Ross, Wiley Chichester.

¹¹⁷ Moffett BF et al (2003): Zinc contamination decreases the bacterial diversity of agricultural soil. FEMS Microbiology Ecology 43, 13-19.

¹¹⁸ Lock K & Janssen CR (2005): Influence of soil zinc concentrations on zinc sensitivity and functional diversity of microbial communities. Environmental Pollution, 136, 275-281.

Objectives

- 7.5. We need to ensure that an appropriate balance is struck between the requirement to increase the recycling of organic materials to soil/land and the risk to ecosystem services posed by contaminants. These pressures are being driven by a number of instruments e.g. the Waste Framework Directive and the targets associated with the Landfill Directive. However, recycling to land and decomposition in the soil represents the best practicable environmental option in most circumstances for many organic materials (e.g. sewage sludge, source segregated quality compost), as it effectively closes the carbon loop, returning organic matter to soil from which it was derived.
- 7.6. This work area will particularly address the following objectives:
- **Establish the degree of risk from putting organic materials on soils and the consequences for human, animal and plant health and the environment, and seek to keep these risks at an acceptable level** – by working with others to establish quality standards for organic materials being applied to land and determining the capacity of soils to accept these materials at levels which does not increase the risk to human health and the environment.
 - **Reduce the rate of soil organic matter decline and protect habitats based on organic soils, such as peat bogs, to maintain our carbon stores (to mitigate climate change) and soil quality** – this chapter will address the first part of this objective by establishing standards to encourage the sustainable recycling of organic materials to land, which will protect and enhance soil organic matter; and the use of recycled organic materials in growing media where applicable.
 - **Ensure that measures for the protection of soil functions in respect of agricultural and forest soils are effective, targeted and proportionate, take into account future pressures including our changing climate and minimise adverse impacts on air, water, biodiversity and greenhouse gas emissions** - by ensuring that the application of organic materials to agricultural land is beneficial and the levels of associated pollution minimised and that alternatives to regulation are pursued where appropriate, e.g. quality protocols.

Ongoing action and areas for development

- 7.7. There are regulatory controls in place to ensure that these activities do not present unacceptable risks to human health and the wider environment. However the increasing amounts of material seeking disposal routes and the long term investment needed to build recycling facilities, means that Government needs to send clear signals on the markets and land bank available for recycling.

Land bank

- 7.8. The availability of a suitable land bank (i.e. stock of land suitable to receive organic materials), at both a national and local scale, will be a key factor in deciding to what extent it is feasible and practical to recycle organic materials to land. Clearly, not all soils or land uses are suitable for the recycling of organic

materials. The ALLOWANCE¹¹⁹ project, which began in December 2005, is **developing a strategic management tool that will quantify and locate, temporally and spatially, the national capacity of agricultural land to accept organic materials** such as farm manures, biosolids (sewage sludge), industrial 'wastes' and municipal composts etc.

Quality Protocols: Compost and Anaerobic Digestion

7.9. As part of the Business Resource Efficiency and Waste (BREW) waste protocols project (see Annex C), a Technical Group was set up in 2006 to consider the feasibility of producing a Quality Protocol based on the quality standard BS PAS 100¹²⁰ that would enable the point of recovery of source segregated organic waste into compost to be moved closer to the point of production, so that quality compost ceases to be waste. A quality protocol for the production and use of quality compost was published in March 2007 and came into force in May 2007. It is designed to provide users with confidence in the quality of the material; ease the regulatory burden; and protect the environment (including soil) and human health by setting standards for the use of quality compost on land. As part of the measures to protect soil the quality standard sets limits for metals in quality composts and the quality protocol requires records to be kept of the metal levels in the soil before and after application. This quality protocol will encourage the sustainable use of quality compost without increasing the risk to human health and the environment from potential contaminants, particularly metals. Other forms of compost will be considered in future. A commitment has been made **to develop a standard and protocol for digestate**, produced from the anaerobic digestion of manures, slurries and other organic wastes, by spring 2008 as part of proposals to speed up the growth of anaerobic digestion contained within the UK Biomass Strategy and the Waste Strategy.¹²¹

Waste Framework Directive

7.10. In December 2005 the European Commission published a Thematic Strategy on the prevention and recycling of waste and proposals for associated legislation including a revision of the Waste Framework Directive. One of the proposed reasons for the revision is the introduction of an environmental objective that 'focuses the Directive on the reduction of environmental impacts from waste generation and management, taking into account the whole life cycle'. In October 2006 a consultation exercise was undertaken to invite views on the revised Waste Framework Directive to ensure that the UK's involvement in the negotiations on the legislation would be well informed and had an evidence base which was as sound as possible. At the Environment Council on 28 June 2007, the Council reached political agreement on the proposed revision to the Waste Framework Directive. **Negotiations on the revision to the Waste Framework Directive may conclude towards the latter part of 2008.**

¹¹⁹ Defra project ES0128: Agricultural Land and Organic Waste - A National Capacity Estimator (ALLOWANCE). See Defra Science website pages.

¹²⁰ British Standard (2005) BS PAS 100:2005 Specification for composted materials. British Standards Institute, London.

¹²¹ A shared vision, a shared responsibility – David Miliband's speech to the National Farmers Union Annual Conference, 26 February 2007.

Sewage Sludge Directive

7.11. The European Commission has indicated that it may review the Sewage Sludge Directive to ensure that maximum benefit can be gained from the organic matter and nutrients in sewage sludge while avoiding problems which could arise from dangerous substances in soil¹²². **Defra will ensure that the Commission is aware of sludge research in the UK, including a project investigating the impact of metals on soil fertility**¹²³.

Evidence base

7.12. **Defra is developing research to assess the impact on soil of applying composts from different sources to land.** This will contribute to a growing evidence base in this area that will underpin future revisions of compost standards and management guidance and allow robust risk assessments to take place.

Success

7.13. Successful delivery of this work area will ensure there is clear encouragement to recycle organic materials, such as composts, to land at application rates and times that deliver improvements in soil quality and agricultural sustainability whilst not impairing the long term functioning of the soil microbial biomass, or presenting a risk to human health and that organic materials are successfully recycled in this way.

Key next steps

7.14. The following actions have been identified. They are the proposed next steps only and the achievement of these actions will not on their own lead to the delivery of this priority work area's objectives and success criteria:

- Continue to work with the Environment Agency and Waste and Resources Action Programme to develop standards and protocols for the recycling of organic materials to land (2008).
- Continue to play a full part in the negotiations to revise the Waste Framework Directive and Sewage Sludge Directive (2008).

¹²² EU Thematic Strategy for Soil Protection (2006): Communication.

¹²³ Defra project SP0130: Effects of sewage sludge on agricultural productivity and soil fertility. See Defra Science website pages.

Questions

- Q7.1** Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?
- Q7.2** Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success (see paragraph 7.13).
- Q7.3** Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?
- Q7.4** Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.
-

Box 11: Key elements of proposed activity within the protection of soil during the recycling of organic materials to land priority work area

Land Bank: Defra is developing a strategic management tool that will quantify the national capacity of agricultural land to accept organic materials.

Quality Protocols: Compost and Anaerobic Digestion: Defra and the Environment Agency are developing a standard and quality protocol for anaerobic digestate.

Waste Framework Directive: Negotiations on the revision to the Waste Framework Directive are continuing, and may conclude towards the latter part of 2008.

Sewage Sludge Directive: Defra will ensure that the latest research results on metal impacts are taken into account in any review.

Evidence base: Defra will develop research to assess the impact on soil of applying composts from different sources to land.

Chapter 8: Evidence

Background

- 8.1. Evidence is central to good policy making: providing evidence for decision-making and new policy solutions, and helping to identify and tackle future issues - the key benefit being better policy. Improving the evidence base strengthens the understanding of why we may need a new or revised policy, and puts into context the policy that will be implemented.
- 8.2. We rely on research to understand the causes of soil degradation and to develop best practice to mitigate the effects. As well as evidence from research programmes we need to monitor soils in order to determine the state of and change in our soils (particularly in relation to the ability of soil to provide ecosystem services and the pressures acting on soil) and to underpin and evaluate the effectiveness of our policy. Many soil properties change only very slowly and soil monitoring cycles tend to be 5-15 years apart. Plans for future soil monitoring are outlined in paragraph 8.11.
- 8.3. England is fortunate in the amount of information that has been collected and analysed on its soils. These long term datasets are being maintained and form an important resource for examining trends in soil properties. For example, the investigation of this data has provided the evidence that soil carbon is declining (due to land use change, management practice or possibly climate change) (see paragraph 2.18). More effort is needed to ensure that this data is accessible to different user groups (see paragraphs 6.20-6.21).
- 8.4. Together with our partners we fund a wide range of projects covering and beyond the scope of the First Soil Action Plan. In particular to investigate 1) the impacts of land application of organic materials on soil quality, 2) the mechanisms behind soil degradation, and 3) impacts on water and air quality. This evidence has been used to provide guidance for land managers (e.g. Cross-Compliance Guidance, Erosion Risk Assessments), and to develop and target resource protection options under Environmental Stewardship. It has also been helpful in deciding which catchments are at most risk of failing to meet Water Framework Directive requirements. Details of Defra's recent and current soil protection research are available on the Defra website¹²⁴.
- 8.5. Research was undertaken in 2006 to estimate the economic value of soil functions and to develop a method to assess total soil valuation¹²⁵. This found that the lack of current knowledge of the quantitative connections between soil properties and their functions, as well as the value that society places on these functions, meant that the possibility of quantification of such benefits was limited. Further consideration needs to be given to quantification of benefits in line with Defra's Ecosystems approach to environmental policy (see paragraph 3.15).

¹²⁴ <http://randd.defra.gov.uk/>

¹²⁵ King et al (2006): Economic valuation of soil functions: Phase 1 - method development. See Defra Science website pages – Defra project SP08004.

- 8.6. There is also a wide range of soils research funded by other UK funders. From 1995-2003 soils research in the UK was funded at a relatively constant level of £25-28 million per annum¹²⁶.

Plans

Research

- 8.7. The collation and use of evidence is key to shaping proportionate policy measures that ensure protected and sustainably managed soils. There are still significant knowledge gaps in relation to achieving our outcomes. Some of our evidence requirements are detailed throughout the Strategy, e.g. impacts of climate change on soil (see paragraph 4.14), soil carbon storage, loss pathways and protection (see paragraphs 5.24-5.25), and the impact of applications of organic materials to land (see paragraph 7.12).
- 8.8. We also need sufficient evidence on the ecosystem services that soils provide for society; the value of these services; assessments of the threats they face; and on the means to mitigate these threats. This will require interdisciplinary working across the natural and social sciences.
- 8.9. **We are developing our future evidence requirements and research priorities for each of the Strategy's work areas and will draw these together into a cohesive research programme.**
- 8.10. Some of the evidence requirements highlighted throughout the Strategy are more appropriately funded by others. This includes topics such as the role and measurement of soil biodiversity and better tools for assessing the physical and hydrological status of soils.

Monitoring

- 8.11. The UK Soil Indicators Consortium¹²⁷ (a cross-Government working group, led by Defra) was formed in 2003 to develop a set of robust indicators of soil quality, and a UK-wide soil monitoring scheme. A preliminary set of indicators have been tested, though further work is needed on the biological indicators, and a stock-take has been completed of existing environmental monitoring to inform the design of a monitoring scheme. **Work is underway to design a new monitoring scheme and, following the completion of this work, we plan to undertake soil monitoring in 2008-10. Defra-funded research is also underway to trial selected biological indicators alongside the soil monitoring being undertaken as part of Countryside Survey 2007.**

¹²⁶ Archer et al (2003): Audit of UK soil research. See Defra Science website pages – Defra project SP0524.

¹²⁷ <http://www.defra.gov.uk/environment/land/soil/research/indicators/consortium/index.htm>

Success

8.12. Successful delivery of this work area will ensure that there is appropriate evidence to evaluate and underpin the development of policies to protect soil and that Government Department research programmes are coordinated with other funders to achieve greater value for money, and that research needs are clearly articulated for the effective management of our soils, so that research councils are encouraged to address them.

Key next steps

8.13. The following actions have been identified. They are the proposed next steps only and the achievement of these actions will not on their own lead to the delivery of this Strategy's objectives and this work area's success criteria:

- Identify research priorities for 2007/08–2010/11 and work with research commissioners to develop the soil programme.
- Identify funds needed to meet priorities on soil carbon, contamination, and monitoring. Work closely with other R&D budget holders to coordinate R&D commissioning.
- Ensure that a robust system of indicators and monitoring is in place to inform the assessment of the delivery of soil protection policy in England (2008).
- Select and use appropriate biological indicators of soil quality following the field-testing of a short-list of indicators (to be completed by the end of 2008).
- Evaluate the quality and success of the Defra Soil Protection R&D programme (2008)

Questions

Q8.1 Views are invited on our plans for this work area. Do you agree with our plans and how we plan to achieve them? Have we missed anything significant?

Q8.2 Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success (see paragraph [8.12](#)).

Q8.3 Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?

Chapter 9: Stakeholders

Background

- 9.1. Given the range of ecosystem services delivered by soil and the many land use activities that interact with soil, it is inevitable that many Government Departments, Agencies and stakeholders have a stake in soil policy development or a role in delivering our outcomes. The partnerships developed during the establishment and delivery of the First Soil Action Plan will need to be maintained in order to deliver this Strategy.
- 9.2. Defra has been working with a large range of stakeholders, in particular those represented on the Soil Action Plan Advisory Forum. Membership of this forum is given at Annex D and includes key Government Department and Agency partners responsible for delivering different parts of the Action Plan, i.e. Communities and Local Government (CLG), English Heritage (EH), Environment Agency (EA), Forestry Commission (FC) and Natural England (NE), as well as representatives of the farming, environmental and academic/research sectors. Government partners not represented on the forum, but who have also been involved in the delivery of different parts of the Action Plan include the Department for Business, Enterprise and Regulatory Reform (BERR), the Department for Children, Schools and Families (DCSF) and Local and Regional Governments. We have also worked closely with the Devolved Administrations on areas where we share common interests.

Plans

- 9.3. A key element of delivering this Strategy will be in **finalising and formalising agreements on effective working arrangement between Defra and the Environment Agency, Natural England and the Rural Payments Agency** so we are clear where lead and support responsibilities reside on each of the priority work areas. **Further engagement is needed between Defra, CLG and BERR** on delivering the built environment priority work area, so that soils are considered and appropriately managed during construction and development activities and decisions.
- 9.4. Local and Regional Government have key roles to play in the delivery of our outcomes and we need to **build on recent progress**. The Local Government Association's Green Communities Campaign (launched October 2005) produced a campaign kit¹²⁸ that includes 9 key soil ideas for local authorities to take action. A further aspect of the campaign is to develop a networking hub to provide a support service for environmental services. Defra are sponsoring the soil component of this and intend to use this to **share examples of best practice, toolkits and guidance and provide sources of information**. We will build on work with the Government Offices to ensure appropriate coverage of soils in Regional Spatial Strategies and other planning activities. **We will continue to develop tools to translate our strategic vision for soils into practical tools and information that can be applied at the local level.**

¹²⁸ Local Government Association (2005): Greening Communities: Ideas into action – Soil.

9.5. Soil is a devolved policy area and whilst this proposed Strategy is for England only there are many similarities in the issues facing soils throughout the UK. **We will continue to work with the Devolved Administrations on many of the priority work areas, with particular emphasis on halting the decline of soil carbon.**

9.6. **We will continue to work with key stakeholders in the delivery of all of the priority work areas and will develop new partnerships as needed.**

9.7. The Soil Action Plan Advisory Forum will become the Soil Strategy Advisory Forum. We plan to hold annual meetings, which will be open to stakeholders outside of the Advisory Forum, to provide an update on progress and future plans, with ad hoc meetings on specific topics as required.

Success

9.8. Successful delivery of this work area will ensure that our partners are committed to achieving our outcomes for soil policy and that there is a clear understanding where the responsibilities for delivery lie.

Key next steps

9.9. The following actions have been identified. They are the proposed next steps only and the achievement of these actions will not on their own lead to the delivery of this Strategy's objectives and this work area's success criteria:

- Agree deliverables in Environment Agency, Natural England and Rural Payment Agency corporate strategies and plans and work with these organisations to secure necessary funding to carry out their role (2008).
- Continue to work with Communities and Local Government and Department for Business, Enterprise and Regulatory Reform to deliver the built environment priority work area so that soils are properly considered in land use decision making and appropriately managed during construction and development activities.
- Continue to develop relationships with Local and Regional Government and agree how they can deliver soil protection outcomes.

Questions

Q9.1 Views are invited on our plans for this work area. Do you agree with our plans and how we plan to achieve them? Have we missed anything significant?

Q9.2 Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success (see paragraph 9.8).

Q9.3 Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?

Chapter 10: Monitoring and evaluation

- 10.1. Whilst Defra has reported annually on the progress made in completing each of the actions in the First Soil Action Plan, there has not been a full evaluation of the impact of the programme of work. Most of the actions have been delivered through the use of existing policy levers. These will be undergoing their own evaluations and we are working through these programmes to deliver a robust analysis of whether current measures are helping to achieve our vision. For some of the key policy levers, e.g. cross-compliance and Environmental Stewardship, evaluation information should become available during 2008 and we will use this to decide the future direction. Other areas of work are still at the policy development and implementation phases and we will need to develop appropriate mechanisms to evaluate our success in these areas.
- 10.2. **We will continue to undertake an annual review of progress** against the objectives and identified measures of success. This will form the basis of both an annual report to be published on the Defra website and an annual stakeholder meeting (see paragraph 9.7).
- 10.3. We will be **carrying out a programme of soil monitoring** during the period 2007-2009 as part the next Countryside Survey and during 2008-2010 under a new UK Soil Monitoring Scheme. The results of this monitoring will be used, alongside the evaluation of each policy, to **determine the impact of our work on protecting soils and allow us to draw up further options as necessary to deliver our outcomes.**
- 10.4. **We will work with stakeholders to develop further measures of success.**
- 10.5. As set out in paragraph 1.13 this is intended to be a long-term Strategy. The Strategy will be evaluated, reviewed and updated in around 5 years time.

Questions

Q10.1 Views are invited on our plans for reporting progress and holding an annual stakeholder meeting. Do you agree with our planned approach? Would you be interested in being involved in these meetings?

Q10.2 Do you have any suggestions for measures of success?

Annex A: Summary of consultation questions

The full list of questions, including where they can be found in the document, is summarised below:

Question number	Question	Page number
Q1.1	Do you agree that a strategic document is required to set out domestic soils policy?	10
Q1.2	Do you agree with our decision to have a Soil Strategy rather than a second Action Plan?	10
Q2.1	Do you agree with our analysis of the evidence of pressures on soils?	22
Q2.2	Do you have any other evidence/valuations that we should consider?	22
Q3.1	Views are invited on our vision.	27
Q3.2	Views are invited on our objectives. Do you agree with our proposed objectives? Is it important that we set these objectives? Have we missed anything significant?	27
Q3.3	Views are invited on the priority and supporting work areas. Do you agree that these are the priority areas for future work on soils? Have we missed anything significant or included areas which are not important?	27
Q3.4	What are your views on the topics which have not been identified as a priority for Defra action?	27
Q4.1	Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?	35
Q4.2	Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success.	35
Q4.3	Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?	35
Q4.4	Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.	35
Q5.1	Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?	45
Q5.2	Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success.	45

Q5.3	Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?	45
Q5.4	Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.	45
Q6.1	Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?	55
Q6.2	Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success.	55
Q6.3	Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?	55
Q6.4	Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.	55
Q7.1	Views are invited on our objectives for this work area. Do you agree with the proposed objectives and how we plan to achieve them? Have we missed anything significant?	61
Q7.2	Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success.	61
Q7.3	Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?	61
Q7.4	Views are invited on the potential social, economic and environmental costs and benefits of this work area as a whole and on the next steps proposed.	61
Q8.1	Views are invited on our plans for this work area. Do you agree with our plans and how we plan to achieve them? Have we missed anything significant?	64
Q8.2	Views are invited on what success would mean for this work area and the priority that should be put on each of our indicators of success.	64
Q8.3	Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?	64
Q9.1	Views are invited on our plans for this work area. Do you agree with our plans and how we plan to achieve them? Have we missed anything significant?	66
Q9.2	Views are invited on what success would mean for this work area and the priority that should be put on each of our	66

	indicators of success.	
Q9.3	Views are invited on our identified key next steps for this work area. Do you agree that these are the correct first steps? Have we missed anything significant?	66
Q10.1	Views are invited on our plans for reporting progress and holding an annual stakeholder meeting. Do you agree with our planned approach? Would you be interested in being involved in these meetings?	67
Q10.2	Do you have any suggestions for measures of success?	67

Annex B: Key elements of proposed activity under the Soil Strategy

The key elements of proposed activity under each Chapter of the Strategy is summarised below:

Chapter 4: Priority area 1: Sustainable soil management in the agriculture and forestry sector

Policy topic	Activity
Air quality	<ul style="list-style-type: none"> Defra will consider how best to improve our understanding of the impacts of air pollutants on ecosystems, including soil communities, and how best to include consideration of these impacts as part of future revisions of the Gothenburg Protocol.
Climate change	<ul style="list-style-type: none"> Defra is working with stakeholders, through the Rural Climate Change Forum, to help the agriculture sector reduce its emissions. Defra will explore the impacts of climate change on soils and consider the implications for soils guidance.
Cross-compliance	<ul style="list-style-type: none"> Defra will need to consider whether current cross-compliance standards deliver effectively and proportionately good soil management across England's farmed land and consider how to optimise the delivery of soil related ecosystem services so that administrative burdens are kept to a minimum.
Diffuse soil pollution	<ul style="list-style-type: none"> Defra and the Environment Agency are assessing the policy implications of research on diffuse soil pollution and will develop a policy response.
Environmental Stewardship	<ul style="list-style-type: none"> Defra will complete the review of Environmental Stewardship and will need to ensure that ES, along with cross-compliance, optimises the delivery of soils related ecosystem services.
Flood risk management	<ul style="list-style-type: none"> Defra and the Environment Agency will complete ongoing projects under the Making Space for Water programme. The EA will take soil and land management issues into account when making decisions on their work on flood risk management (through River Basin Management Plans and Catchment Flood Management Plans) and to work with farmers to improve soil management on farms to reduce localised flooding.
Forestry	<ul style="list-style-type: none"> The Forestry Commission will publish revised Forests and Soil Conservation Guidelines reflecting recent changes in policy and knowledge.
Nutrient management	<ul style="list-style-type: none"> Defra will continue to optimise the use of nutrients to help to deliver environmental outcomes for air, water, soil, climate change and biodiversity.
Protection of water quality	<ul style="list-style-type: none"> Defra will continue to prepare for implementation of the Water Framework Directive.
Reducing	<ul style="list-style-type: none"> Defra will continue to look at ways of benchmarking the

farming's environmental footprint	environmental impact of farming and give guidance on good and best practices that farmers could use to improve their performances. Defra will continue to take forward the revision and publication of a new integrated Code of Good Agricultural Practice.
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Chapter 5: Priority area 2: Halting the decline of soil carbon

Policy topic	Proposed activity
Energy – Biomass and biofuels	<ul style="list-style-type: none"> The Government will seek to deliver an expansion of biomass production in a way which is consistent with an enhanced, sustainable approach to land management. Defra will also lead an interdepartmental project to review evidence and develop and co-ordinate a consolidated UK international biofuels strategy.
Environmental Stewardship	<ul style="list-style-type: none"> Defra will undertake a review of Environmental Stewardship – including the development of the successor to the Hill Farm Allowance (likely to be Uplands Entry Level Stewardship) with Natural England and other stakeholders; encourage the uptake of options to protect carbon stocks (e.g. peat bogs) and address climate change more broadly.
Evidence base	<ul style="list-style-type: none"> Defra will develop a coordinated R&D programme on soil carbon and put in place research.
Heather and Grass Burning	<ul style="list-style-type: none"> Defra and Natural England will work with the industry to encourage good practice through the promotion of the Code and will monitor emerging evidence on the impacts of burning on peat soils and take action as required.
Peat policy project	<ul style="list-style-type: none"> Defra will develop a programme of work to facilitate and coordinate activity within Defra, Welsh Assembly Government, Environment Agency, Forestry Commission and Natural England, and with stakeholders, to protect and enhance peat soils using appropriate policy levers and management options.
Sites of Special Scientific Interest target	<ul style="list-style-type: none"> Defra and Natural England will continue to bring SSSI peat bogs into favourable or unfavourable recovering condition by 2010.
Soil organic matter management in priority catchments	<ul style="list-style-type: none"> Defra and Natural England will establish whether agricultural management practices can be encouraged which result in a reversal or halting the loss of soil organic matter and test and demonstrate 'Active Carbon': an indicator that can be used to determine the direction of change of Soil Organic Matter content.
Sustainable Farming and Food Strategy	<ul style="list-style-type: none"> Defra will undertake monitoring to determine the effectiveness of our actions to halt the decline of Soil Organic Matter and assess what further action is required. Natural England will examine the role of land managers as carbon managers.
UK Biodiversity Action Plan	<ul style="list-style-type: none"> Defra will consider what is already known about peat alternatives, what factors would improve confidence in

	existing alternatives, and what can be done to increase the rate of development of alternatives, as well as addressing public awareness of the need to reduce peat usage.
UK Climate Change Programme	<ul style="list-style-type: none"> Defra will continue to commission further work on the cause of soil carbon decline; and examine the scope and feasibility of potential market based mechanisms to facilitate trading of greenhouse gas reductions from agriculture and other land management sectors. Defra will also continue to work with the Rural Climate Change Forum to raise awareness of climate.

Chapter 6: Priority area 3: Sustainable soil management in the built environment

Policy topic	Proposed activity
British Standard for Topsoil	<ul style="list-style-type: none"> Defra will continue to work with stakeholders to ensure that the construction industry and client community are made aware of the changes. Defra will also work with industry and the Environment Agency to determine if the revised standard could form the basis of a quality protocol designed to remove clean surplus soil from being waste management controls.
Climate change	<ul style="list-style-type: none"> Defra will explore the impacts of climate change on soils in the built environment.
Code of Practice for the sustainable use of soils on construction sites	<ul style="list-style-type: none"> Defra and the Department for Business, Enterprise and Regulatory Reform will produce and promote a code of practice.
Diffuse urban water pollution	<ul style="list-style-type: none"> Defra will continue to review the available evidence on non-agricultural sources of diffuse water pollution and seek to develop mechanisms to tackle the causes.
Land use	<ul style="list-style-type: none"> Defra will include the consideration of soil issues, including valuation of carbon stores and protection of agricultural soils, in the land use debate.
Planning policy	<ul style="list-style-type: none"> Defra will continue to work with Communities and Local Government to ensure that planning policies are implemented effectively; and in particular will consider in liaison with CLG what soil information is required to take decisions at the local level and the best mechanisms for making this available.
Strategic Environmental Assessment/ Environmental Impact Assessment	<ul style="list-style-type: none"> Defra will seek to ensure that sufficient soil information is available for planners and developers to ensure that soil is taken into account in Strategic Environmental Assessments, sustainability appraisals and Environmental Impact Assessments.
Sustainable urban drainage	<ul style="list-style-type: none"> Defra will identify options to enable partnerships to deliver integrated drainage proposals, particularly in high-risk urban areas.

Chapter 7: Priority area 4: Protection of soil during the recycling of organic materials to land

Policy topic	Proposed activity
Evidence base	<ul style="list-style-type: none"> Defra will develop research to assess the impact on soil of applying composts from different sources to land.
Land bank	<ul style="list-style-type: none"> Defra is developing a strategic management tool that will quantify the national capacity of agricultural land to accept organic materials.
Quality protocols: Compost and Anaerobic Digestion	<ul style="list-style-type: none"> Defra and the Environment Agency are developing a standard and quality protocol for anaerobic digestate.
Sewage Sludge Directive	<ul style="list-style-type: none"> Defra will ensure that the latest research results on the metal impacts are taken into account in any review.
Waste Framework Directive	<ul style="list-style-type: none"> Negotiations on the revision to the Waste Framework Directive are continuing, and may conclude towards the latter part of 2008.

Chapter 8: Evidence

Policy topic	Proposed activity
Research	<ul style="list-style-type: none"> Defra is developing its future evidence requirements and research priorities for each of the Strategy's work areas and will draw these together into a cohesive research programme.

Chapter 9: Stakeholders

Policy topic	Proposed activity
Delivery	<ul style="list-style-type: none"> Defra will continue to develop relationships and work with key stakeholders in the delivery of each of the Strategy's priority work areas.

Chapter 10: Monitoring and evaluation

Policy topic	Proposed activity
Monitoring	<ul style="list-style-type: none"> Work is underway to design a new monitoring scheme and, following the completion of this work, Defra plan to undertake soil monitoring in 2008-10.

Annex C: Cross referenced policies in more detail

Best and Most Versatile Land: The policy of Best and Most Versatile Land (BMV) is used to protect agricultural land from development. It advocates that where significant development of agricultural land is unavoidable, poorer quality land should be used in preference to that of higher quality, except where this would be inconsistent with other sustainability considerations. It employs a land classification system known as Agricultural Land Classification. This provides a method for assessing the quality of farmland to enable informed choices to be made about its future use within the planning system. The ALC is based on the long-term physical limitations of land for agricultural use, with factors such as climate, site and soil characteristics, and the important interactions between them determining the eventual classification. Under ALC, land is classified into five grades, with the 'best and most versatile land' defined as Grades 1, 2 and 3a by policy guidance (see PPS7: Sustainable Development in Rural Areas). This is the land that is most flexible, productive and efficient in response to inputs and which can best deliver future crops for food and non-food uses such as biomass, fibres and pharmaceuticals. However, we should see good quality land, as classified under ALC, as a useful proxy for what are inherently good quality soils in terms of their ability to provide the wider range of ecosystem goods and services that we value. However, soil/land is subject to more pressures than development.

Environmental Impact Assessment Directive: European Directive 85/337/EEC, as amended by Directives 97/11/EC and 2003/35/EC, requires projects that are likely to have a significant effect on the environment to undergo an Environmental Impact Assessment before they receive development consent. Likely significant effects to be considered are similar to those for Strategic Environmental Assessments (see below), including effects on soil.

Planning Policy: The aim of the planning system is to help deliver sustainable development: making sure that provision is made for the developments the country requires, taking full account of environmental, resource, economic and social considerations. Section 39 of the Planning and Compulsory Purchase Act 2004 imposes a duty on persons and bodies responsible for preparing a regional spatial strategy (RSS) or local development document (LDD) to exercise those functions with the objective of contributing to the achievement of sustainable development.

The UK Government determines national planning policies and for the most part these are set out in 'white papers' (for example the Government's 2005 UK strategy for sustainable development - Securing the Future), planning policy statements (PPSs) which through the Government's programme of planning reform are replacing planning policy guidance notes (PPGs) and departmental circulars. PPS1 Delivering Sustainable Development sets out the overarching planning policies on the delivery of sustainable development through the planning system, including on the prudent use of natural resources. As set out in PPS1 this includes ensuring that we use natural resources wisely and efficiently, in a way that respects the needs of future generations. This means enabling more sustainable consumption and production and using non-renewable resources (including soils) in ways that do not endanger the resource or cause serious damage or pollution. This national policy framework

must be taken into account by those preparing RSSs and LDDs, and in the determination of planning applications.

Regional planning bodies (RPBs) prepare and produce RSSs reflecting the needs and aspirations for sustainable regional development and land use. These look forward for a ten to 15 year period and reflect, and build on, the policies set out at national level. RSSs provide a broad development strategy including the scale and distribution of new housing, priorities for the environment and agriculture, as well as waste treatment and disposal.

At the local level, local planning authorities prepare LDDs that set out the spatial planning strategy for the local area. Again, these should be prepared having due regard to national policies, and should also be in general conformity with the RSS. Local planning authorities must determine planning applications in accordance with the statutory development plan which comprises development plan documents (a type of LDD) and the relevant RSS, unless material considerations indicate otherwise. Relevant and recent national policy, particularly where this points to a different decision than suggested by the development plan, can be a material consideration.

The Planning and Compulsory Purchase Act 2004 requires the sustainability appraisal of RSSs and LDDs. Sustainability appraisal incorporates the requirements of the Strategic Environmental Assessment (SEA) Directive. This is where the emerging planning strategies and content of RSS and LDDs is tested and the implications for soils considered. The nature and consideration of soils is multifaceted and often complex, with direct or indirect overlap with other policy considerations directly related to the use and development of land, including flood plain management and versatile land use. Sustainability appraisal has been developed as part of the Government's planning reform programme to ensure that the choices which are made during the plan-making process at regional and local level are based on clear evidence of their impacts on society, the environment and the economy. Sustainability appraisal focuses on the full range of social, environmental, and economic effects and integrates environmental concerns with the other pillars of sustainable development. The guide 'Sustainability Appraisal of Regional Spatial Strategies and Local Development Documents' was published in November 2005.

Strategic Environmental Assessment Directive: European Directive 2001/42/EC (the SEA Directive) 'on the assessment of the effects of certain plans and programmes on the environment' requires a formal environmental assessment of certain plans and programmes which are likely to have significant effects on the environment'. Authorities which prepare and/or adopt such a plan or programme must prepare a report on its likely significant environmental effects, consult environmental authorities and the public, and take the report and the results of the consultation into account during the preparation process and before the plan or programme is adopted. They must also make information available on the plan or programme as adopted and how the environmental assessment was taken into account.

The likely significant effects on the environment to be considered include the effects on issues such as biodiversity, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship of these factors.

The SEA Directive is transposed into UK law by the Environmental Assessment of Plans and Programmes Regulations 2004.

Waste Protocols Project: Defra's Business Resource Efficiency and Waste (BREW) Programme was established as a vehicle for returning additional landfill tax receipts from April 2005 to business in a way that supports businesses in improving their resource efficiency and waste management. The Environment Agency and the Waste and Resources Action Programme (WRAP) are two of a number of delivery bodies undertaking initiatives within this programme.

For the Waste Protocols Project, the Environment Agency and WRAP are working jointly to develop clear guidance on how to recover materials in key waste streams. The objective of the project is to develop and produce waste protocols for industry use.

The project aims to deliver waste protocols addressing up to 10 waste streams, providing clarity regarding the point at which waste ceases to be waste, thereby reducing the cost to business in expenditure associated with clarifying regulatory issues. The key priorities of each protocol will be to:

- provide users with confidence that a recovered material conforms to agreed quality standards comparable with those of products made from materials of a non-waste origin;
- protect the environment and human health – by setting standards for the use of the material; and
- ease the regulatory burden – by defining when the material ceases to be waste and no longer needs to be subject to regulatory control.

The 10 waste streams being considered for development of a protocol are: quality compost (PAS 100), waste vegetable oils, flat glass, wood, compost (non PAS 100), pulverised fuel ash, contaminated soils (washed and stabilised), blast furnace slag, tyre (crumb and shred) and plastics (non-packaging).

Five further waste streams were chosen for development of a protocol in 2007/08, in addition to anaerobic digestate. An announcement was made to this effect by the Environment Agency at the end of May 2007.

Annex D: Soil Action Plan Advisory Forum

Membership (current)

ADAS	Highways Agency
Biotechnology and Biological Sciences Research Council	Institute of Grassland and Environmental Research
British Society of Soil Science	Linking Environment And Farming
Campaign to Protect Rural England	National Farmers Union
Centre for Ecology and Hydrology	National Soil Resources Institute
Chartered Institute of Water and Environmental Management	National Trust
CIRIA	Natural England
Communities and Local Government	Natural Environment Research Council
Country Land and Business Association	Reading University (Soil Science Department)
English Heritage	Rothamsted Research
Environment Agency	Royal Society for the Protection of Birds
Forest Research	Soil Association

Terms of reference

The terms of reference of the Soil Action Plan Advisory Forum are:

"To provide a mechanism by which stakeholders can put views to Government on the progress and implementation of the First Soil Action Plan for England. As the lead Department Defra will:

- provide twice-yearly progress reports for all actions in the plan;
- present specific results of progress to the Advisory Forum;
- keep Ministers informed of progress on the plan and views expressed by the Advisory Forum in relation to this;
- publish relevant papers on the Soils part of the Defra website; and
- ensure joined up working with others in pursuit of sustainable outcomes e.g. Environment Agency work on their Soil Strategy, work with the Devolved Administrations, work with Communities and Local Government to influence planners, and work on the EU Thematic Strategy for Soil Protection, in line with the Government's Strategy for Sustainable Development.

Advisory Forum members will:

- provide advice and ideas on the implementation of the actions in the plan;
- provide feedback on progress made on the actions, including ways to overcome difficulties encountered and recommending action when progress has halted;
- offer an independent overview of the implementation and direction of the Action Plan;
- work with Defra and others to take actions forward as necessary;
- discuss additional issues/actions to be included in the Second Soil Action Plan for England;
- assess priority actions in the event of any resource constraints; and
- selectively take part in Working Groups to the Advisory Forum as and when these are necessary to further refine/develop the group's advice to Government."