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Safeguarding our Soils

A Strategy for England



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Ministerial Foreword	2
Executive Summary	4
Chapter 1: Safeguarding our soils	10
Chapter 2: Better protection for agricultural soils	13
Chapter 3: Protecting and enhancing stores of soil carbon	18
Chapter 4: Building the resilience of soils to a changing climate	22
Chapter 5: Preventing soil pollution	25
Chapter 6: Effective soil protection during construction and development	31
Chapter 7: Dealing with our legacy of contaminated land	35
Chapter 8: Future research and monitoring	40
Chapter 9: Working together	42

Ministerial Foreword



Along with air and water, soil is one of the building blocks of life. It gives us food, clothing and fuel. It supports our buildings and infrastructure, stores water and carbon, is home to a wide range of biodiversity and sustains some of our most valued landscapes. Yet it is so much a part of everyday life, in our gardens, parks and even window boxes, that there's a danger of taking it for granted.

I am always struck by the words of President Franklin D Roosevelt over 70 years ago when, promoting the first measures in the world to protect soil, he said "The Nation that destroys its soil destroys itself." He understood the value of soil and the importance to economies and societies of protecting it.

But our soils face pressures now that Roosevelt could never have envisaged. Increasing demands for food and fuel from a growing global population that is forecast to reach 9 billion by 2050, pressures for more land for new housing and transport infrastructure and, most significantly, climate change.

These new pressures will exacerbate many of the threats that soils already face in providing their range of ecosystem services. Soil erosion due to wind and rainfall already results in the annual loss of around 2.2 million tonnes of topsoil in the UK. This costs British farmers £9m a year in lost production. Climate change has the potential to increase erosion rates through hotter, drier conditions that make soils more susceptible to wind erosion, coupled with intense rainfall incidents that can wash soil away.

Soils are an important store of carbon, with those in the UK containing around 10 billion tonnes of carbon, half of which is found in our peat habitats. Losing this store to the atmosphere would create emissions that are equivalent to more than 50 times the UK's current annual greenhouse gas emissions. As the climate warms and rainfall patterns change, there is a growing risk that emissions to the atmosphere from soil will increase, in turn causing further climate change as well as reducing the soil's productive capacity.

Managing the impact of construction and development on soils' essential functions, like absorbing rainwater, is vital. We need to ensure that the planning system provides the appropriate level of protection for good quality agricultural land. While many sources of soil pollution have been dealt with through environmental regulation, challenges remain if we are to manage more diffuse sources, including from atmospheric deposition and spreading waste materials on land, and deal with our industrial legacy of contaminated land.

The new Soil Strategy for England – Safeguarding our Soils – outlines the Government's approach to safeguarding our soils for the long term. It provides a clear vision to guide future policy development across a range of areas and sets out the practical steps that we need to take to prevent further degradation of our soils, enhance, restore and ensure their resilience, and improve our understanding of the threats to soil and best practice in responding to them.

This Strategy supports the aims of the EU Thematic Strategy on Soil Protection but clearly demonstrates the value of national action to protect soils which is responsive to local circumstances. That is why I believe the harmonised European approach that is currently proposed in the draft EU Soil Framework Directive is not the right one.

Good quality soils are essential to achieve Defra's goals of a thriving farming sector and a sustainable, healthy food supply, as well as securing a healthy environment in which we and future generations can prosper. I believe that this Strategy is an important step in increasing the value we place on soil and setting a framework for safeguarding this vital resource now and in the future.

A handwritten signature in black ink, appearing to read 'H. Benn', with a stylized flourish at the end.

Hilary Benn

Executive Summary

Our vision: By 2030, all England's soils will be managed sustainably and degradation threats tackled successfully. This will improve the quality of England's soils and safeguard their ability to provide essential services for future generations.

1. Our vision will mean that:
 - agricultural soils will be better managed and threats to them will be addressed;
 - soils will play a greater role in the fight against climate change and in helping us to manage its impacts;
 - soils in urban areas will be valued during development, and construction practices will ensure vital soil functions can be maintained; and
 - pollution of our soils is prevented, and our historic legacy of contaminated land is being dealt with.
2. Soil is a fundamental natural resource on which life depends. It provides many essential services on which we rely including food production, water management and support for valuable biodiversity and ecosystems. As a large store of carbon it also plays a vital role in the fight against climate change.
3. Our soils have degraded over the last 200 years due to intensive agricultural production and industrial pollution. Soils in England continue to face three main threats:
 - **Soil erosion by wind and rain.** Erosion affects both the productivity of soils but also water quality and aquatic ecosystems.
 - **Compaction** of soil reduces agricultural productivity and water infiltration, and increases flood risk through higher levels of run off.
 - **Organic matter decline.** The loss of soil organic matter reduces soil quality, affecting the supply of nutrients and making it more difficult for plants to grow, and increases emissions to the atmosphere.
4. All these threats may be magnified by climate change. Safeguarding our soils for future generations means managing them better, reducing degradation and building resilience to increasing pressures in order to provide a sustainable food supply and cope with our changing climate.
5. Soil changes slowly, and our understanding of these changes is incomplete. In addition, the impacts of our actions today may not be seen for many years. To prevent degradation of our soils we need to develop our knowledge and start taking action now to build the necessary resilience to the challenges we will face in the future.
6. This Strategy highlights those areas which we will prioritise and focus our attention in tackling degradation threats. We will deliver this Strategy primarily through improving our evidence base, providing information and guidance to those who are actively managing our soils, and using regulation and incentives where necessary to drive further action. However, government alone cannot safeguard our soil resource for future generations. Farmers and other land managers, developers, planners and construction companies must all play their part in managing soils sustainably and protecting soil functions. Consumers must also be given the information they need to make responsible choices when buying products such as compost.

Better protection for agricultural soils

7. Farmers, foresters and other land managers manage the majority of our soils. Achieving our vision means working in partnership with a range of organisations to promote good practice and incentivise improved management of our agricultural soils.



Rothamsted Research

8. We have already made significant progress in preventing soil degradation through existing programmes such as CAP cross compliance, Environmental Stewardship, the England Catchment Sensitive Farming Delivery Initiative and the new Code of Good Agricultural Practice.¹ The challenge now is to improve the effectiveness of these tools in the light of emerging evidence about the causes of soil degradation and the best ways to prevent it. We also need to consider new threats to soils and ensure that these do not become significant problems in the future.

9. We currently spend £5 million a year on soils and water management research and will continue to invest in improving our understanding of how degradation affects soil functions and how best to tackle it. We will build on existing information and guidance for farmers and landowners to ensure that the industry has the necessary skills and knowledge to tackle soil degradation. This will include publishing new guidance on good agricultural practice to protect and increase soil organic matter.
10. As part of the review of CAP cross compliance, we will introduce a revised Soil Protection Review from January 2010 in order to improve soil protection and simplify the process for farmers wherever possible. We will also review the need for future options under Environmental Stewardship to improve soil protection and examine opportunities for further targeting of action on key sites.

Protecting and enhancing stores of soil carbon

11. UK soils store over 10 billion tonnes of carbon in the form of organic matter. The size of this store means soil has a vital role to play in helping to combat climate change. Preventing emissions from soil and exploring how to increase existing stores of soil carbon can make an important contribution to meeting the Government's emission reduction targets and carbon budgets, introduced by the Climate Change Act 2008.

¹ Cross compliance is a set of standard requirements of the Common Agricultural Policy (CAP) to protect soils and maintain a range of both habitat and landscape features for anyone claiming payments under the Single Payments Scheme. Environmental Stewardship is the main agri-environment scheme in England (covering over half of England's farmland) and provides funding to farmers and other land managers who deliver effective environmental management on their land. One of its five primary objectives is to help protect natural resources, including soil. The England Catchment Sensitive Farming Delivery Initiative (ECSFDI) aims to tackle diffuse water pollution from agriculture in order to meet the objectives of the Water Framework Directive. The *Code of Good Agricultural Practice* (CoGaP) offers a practical interpretation of legislation and advice on agricultural best practice.

Executive Summary

12. Over half of the UK's soil carbon store is contained in peat soils. A number of measures are already in place to protect and enhance peat, and the valuable biodiversity it supports. The Partnership Project on Peat, set up in 2008, brings together Defra, the statutory agencies and devolved administrations to coordinate action.



Defra

13. A robust evidence base is needed to underpin the development of policies and measures to protect soil carbon. We need better evidence on trends in soil carbon levels and cost-effective techniques for protecting or increasing soil carbon, and protecting, managing and restoring peatlands. We must also explore the benefits which could potentially be achieved from emerging technologies, for example biochar (a way of locking carbon in soil in the form of charcoal).



Defra

14. We must do all we can to ensure that the existing carbon store is protected. To focus future actions and ensure that all future policy development on soils is guided by the need to protect our existing carbon stores this strategy establishes a new goal to significantly reduce the rate of loss of stored soil carbon by 2020. To support this we will develop a new framework for action for protecting our valuable peat habitats including new measures to encourage a further reduction in horticultural use of peat once the current target period comes to an end in 2010.

Building the resilience of soils to a changing climate

15. The latest UK Climate Projections 2009² show that as a result of climate change the UK is likely to see hotter drier summers and warmer wetter winters, coupled with increased frequency of extreme weather occurrences such as heat waves, dry spells, heavy rain and flooding. This has the potential to have a significant effect on our soils and increase the risk of their degradation and associated costs, including lost production.
16. We need to understand better the likely impacts of climate change on soil and ensure our policy framework supports land managers in building resilience to a changing climate and protecting the existing carbon store. Soils also have the potential to support wider adaptation of the economy and society to climate change. For example, if well managed, soils can cope better with drought and regulate drainage of heavy rainfall, helping to prevent flooding.

17. We will continue to model the possible impacts of climate change on our soils using the new projections and use this information to identify any changes needed to soil management practices to make soils, including peat soils, more resilient to a changing climate.

Preventing soil pollution

18. The gradual build up of pollutants over many years through diffuse pollution is a serious threat to soil functions. Pollutants enter the soil from many sources and can adversely affect human health if they enter into the food chain or drinking water sources. Remediating soils which contain pollutants is difficult and expensive and so action must focus on preventing soil pollution wherever possible.



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Spreading organic materials to land

19. Defra has carried out a large programme of research to better understand the risk of soil pollution and evidence suggests that most sources of soil pollution are now suitably controlled. However, continued atmospheric deposition and the increase in the spreading of organic and inorganic materials to land is an area of growing concern.
20. Spreading recycled materials to land is important for increasing soil organic matter, reducing fertiliser requirements and diverting suitable materials from landfill. We will ensure that the return of materials to land is encouraged whilst continuing to monitor trends in pollutants and investigate further the potential for reducing pollutants entering soil through recycled materials. We will also keep under review the current thresholds for heavy metals entering soil, as well as existing advice, quality protocols and standards for the use of materials spread to land to ensure that they reflect the latest scientific understanding.
21. We will continue to play an active role in international discussions on long range air pollution and in the European Union, for example on the possible Biowaste Directive suggested by the European Commission Green Paper, to further our objectives and ensure discussions are informed by the developing UK evidence base in this area.

Effective soil protection during construction and development

22. Soils play an important role in urban areas in supporting ecosystems, improving drainage and providing green space for communities. They are subject to many demands and pressures and, if not managed carefully during construction and development, these important functions can be lost.
23. Pressures on our soils and competition for land are likely to increase in future with expected population growth. We need to understand these trends better and the changing demands on our soils. We also need to ensure that appropriate consideration is given to soils in the planning process and we will publish a new toolkit for planners in 2010 to help them to take account of soil functions, including soil carbon storage, in the planning system.

Executive Summary

24. We must ensure that planning decisions take sufficient account of soil quality, particularly when significant areas of the best and most versatile agricultural land are involved. Together with Communities and Local Government (CLG), we will review the effectiveness of existing planning policy to protect important soils and consider whether there is a need to update it.
25. We will encourage better management of soils during the construction process to prevent pollution and unnecessary compaction. Alongside this strategy we are publishing, jointly with the Department for Business, Innovation and Skills (BIS) and the Waste and Resources Action Plan (WRAP), a new code of practice for soil use on construction sites and will encourage take up within the construction industry.³



Defra Photo Library

Dealing with our legacy of contaminated land

26. Our industrial heritage has left us with a substantial legacy of sites with soils that are contaminated with chemicals from human activities. These sites can pose a significant risk to human health and the environment. Regulation is in place under the Environmental Protection Act 1990 and through the planning system to ensure that contaminated land is identified and remediated through market activity wherever possible. Fiscal incentives and brownfield redevelopment targets have driven the cleaning up of large areas of former industrial land.
27. We need to continue to develop our understanding of the impacts of contaminated land on human health and the environment to ensure relevant policies are appropriate and proportionate. We also need to continue to support Local Authorities in delivering the existing regime more effectively. Building on guidance published in July 2008 on The Legal Definition of Contaminated Land, we will publish new best practice guidance on decision making later this year to help Local Authority officers make proportionate and robust decisions more confidently. It will also continue to encourage moves to more sustainable remediation practices that do not involve the wholesale removal and replacement of soil.
28. We will continue to provide funding for those sites which pose a significant risk to human health and the environment and where no other solution can be found. During 2009/10 £17.5 million of Defra funding was available to support Local Authorities in investigating and remediating contaminated sites.

Future research and monitoring

29. Defra funds a wide range of research in partnership with other organisations. Key gaps in our evidence base are highlighted throughout the strategy. We will work closely with other funders to coordinate the commissioning of research to fill these gaps and strengthen our understanding of the pressures on soils and the measures required to address degradation.

³ See the Defra website for the new *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites*.
<http://www.defra.gov.uk/environment/land/soil/htm>.

30. Soil monitoring provides vital evidence on the state of, and change, in our soils, underpinning policy development and allowing us to evaluate its effectiveness. Long term monitoring of the state of the natural resources of the UK's countryside has been carried out since 1978 through the Countryside Survey, which includes analysis of soils. We will continue to use the Survey to collect data, but will also explore options for collecting additional information through other monitoring schemes. As part of this we will establish a wider set of soil quality indicators, building on the work of the UK Soil Indicators Consortium. We are also currently trialling some new biological indicators of soil quality for possible inclusion in future soil monitoring programmes.

Working together

31. Many Government Departments, Agencies and stakeholders have an interest in soil policy or a role in delivering our outcomes. To strengthen our partnerships, we will review and extend the membership of the Soils Advisory Forum. The Advisory Forum will play a key role in future policy development as well as assisting with monitoring and evaluating the delivery of this Strategy.
32. Soil is a devolved policy area and whilst this Strategy is for England only, there are many similar issues facing soils throughout the UK. We will continue to work with the Devolved Administrations on many of the priorities set out in this Strategy to ensure that our approach is consistent. Such engagement at the UK level will also help to promote more effective information exchange, particularly in relation to soil research.
33. We will also continue to promote sharing of best practice in soil protection at the European level. This Strategy has been informed by key elements of the EU *Thematic Strategy for Soil Protection*⁴ that was published in September 2006. In ongoing discussions on the proposed EU Soil Framework Directive we will continue to argue for a flexible and proportionate approach which complements existing national action.

Summary of key new actions:

- Revised CAP cross compliance Soil Protection Review to launch in January 2010.
- A review of the need for future options under Environmental Stewardship to improve soil protection.
- A new goal to significantly reduce the rate of loss of stored soil carbon by 2020.
- A commitment to developing a new framework for action for peat protection, including on horticultural peat use post 2010.
- Reviewing thresholds for pollutants entering soil through recycling materials to land.
- Publishing a new code of practice for soil use on construction sites and a new toolkit for planners in 2010 on how to take account of soil functions through the planning system.
- Reviewing the effectiveness of the existing planning policy to protect important soils and whether there is a need to update it.
- Publishing new best practice guidance on decision making for contaminated land.

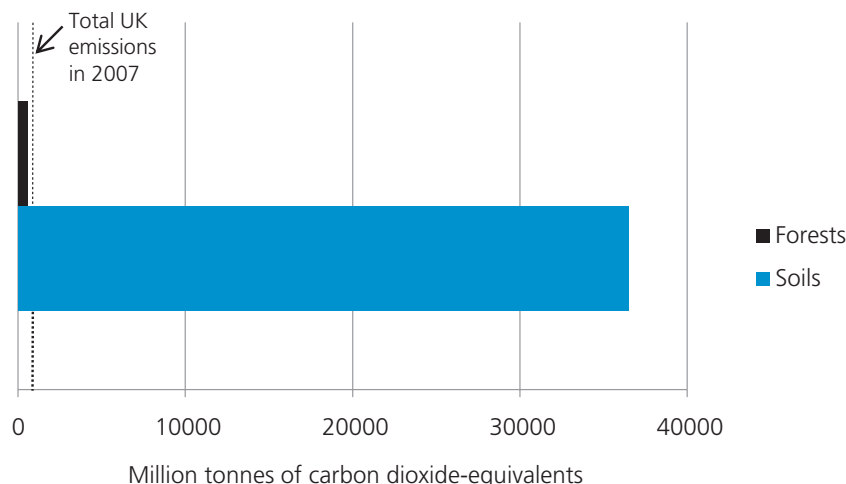
4 http://ec.europa.eu/environment/soil/three_en.htm

Chapter 1: Safeguarding our soils

Our vision: By 2030, all England's soils will be managed sustainably and degradation threats tackled successfully. This will improve the quality of England's soils and safeguard their ability to provide essential services for future generations.

- 1.1 Our vision will mean that:
- agricultural soils will be better managed and threats to them addressed;
 - soils will play a greater role in the fight against climate change and in helping us to adapt to its impacts;
 - soils in urban areas will be sufficiently valued for the ecosystem services they provide and given appropriate weight in the planning system.
 - where development occurs, construction practices will ensure that vital functions can be maintained; and
 - pollution of soils is prevented and our historic legacy of contaminated land is being dealt with.
- 1.2. With air and water, soil is one of the fundamental natural resources on which life depends. It gives us food, timber and many other essential crops. It supports our infrastructure and cultural heritage, shapes our landscape and supports a wide range of biodiversity. It filters and stores water and holds large amounts of carbon. Protecting these vital services for future generations is essential.
- 1.3. Historically soil protection was driven by maintaining our ability to grow food and other important crops. Farmers and other land managers employed techniques such as crop rotation which allowed soils to naturally regenerate and grow crops sustainably. Over time technological advances, like fertilisers, have allowed us to compensate for poor quality or degraded soils and produce crops more intensively to meet society's demands. But we now recognise that this approach is not sustainable in the long term. The cost of inorganic fertiliser has risen over recent years, and is likely to remain high in the future, and we are increasingly concerned about problems such as leaching and runoff which can affect watercourses and aquatic ecosystems, and the need to reduce our dependency on fossil fuels.
- 1.4. We also recognise the importance of soils in the fight against climate change. UK soils contain 10 billion tonnes of carbon – more than in all the trees in the forests of Europe (excluding Russia). This is equivalent to more than 50 times the UK's current annual greenhouse gas emissions (see Figure 1). Well-managed soils have the potential to sequester more carbon in future, but more needs to be done to understand and optimise this process. Soils can also help us to adapt to a changing climate and, through changing managing practices, increase our ability to deal with changes in our climate.

Figure 1: Carbon stored in UK forests and soils



Source: Defra

- 1.5. We must safeguard our soils for the future. This means managing them better, reducing degradation and ensuring they continue to provide a sustainable food supply whilst at the same time coping with a changing climate.

Threats to soil

- 1.6. Many of our soils have degraded over the last 200 years due to intensive agricultural production and industrial pollution. While this degradation has not been as severe as in many other parts of the world, some areas of England have seen major losses in soil functions. Soils in England face three main threats from degradation:

- **Soil erosion.** The most significant threat facing our soils is from erosion by wind and water. Around 2.2 million tonnes of topsoil is eroded annually in the UK⁵, significantly affecting the productivity of soils and impacting on water quality and aquatic ecosystems through the silting up of watercourses. The total cost of soil erosion is currently estimated at around £45 million per annum including £9 million in lost production.⁶
- **Organic matter decline.** The loss of soil organic matter severely reduces soil quality (affecting the supply of nutrients and making it more difficult for plants to grow) and represents a loss of soil carbon. Soils with low levels of organic matter hold less water and are less resistant to drought and erosion. The Environment Agency estimates the costs of organic matter decline due to cultivation to be about £82 million per annum.⁷
- **Compaction** of soil reduces agricultural productivity and water infiltration and, through higher levels of run-off, increases flood risk. Unlike soil erosion it is reversible through changes to land management practices.



Erosion gully

Cranfield University



Waterlogged soil

Defra

⁵ Environment Agency (2004), *The State of Soils in England and Wales*.

⁶ Soil erosion costs primarily include loss of productivity, water treatment, damage to property and dredging stream channels (EA 2007).

⁷ EA (2007), *The Total External Environmental Costs and Benefits of Agriculture in the UK*.

Chapter 1: Safeguarding our soils

- 1.7. Climate change may magnify these threats. Hotter drier summers will lower soil moisture levels and lead to greater levels of wind erosion. Wetter warmer winters and more regular extreme rainfall events may increase erosion through water runoff, cause increased waterlogging, and increase the risk of compaction occurring. Higher temperatures may also accelerate the loss of carbon from our soils by increased oxidation rates. All of which will increase the costs due to soil degradation, including from lost productivity.
- 1.8. The functions that soils provide are also at risk from pollution by heavy metals and chemicals, acidification from the air deposition of substances like ammonia and increasing pressure for development leading to losses of soil (soil sealing). Further details on all the threats that soils face can be found in the Evidence Paper which accompanies this Strategy and has been published online.⁸
- 1.9. Soil changes slowly, and the impacts of our actions today may not be seen for many years. There is also much that we still do not know about soil and how it may be affected by a changing climate. To prevent future degradation of our soils we need to develop our knowledge and start taking action now to build resilience. It is also clear that Government alone cannot take all the steps necessary to safeguard our soil resource for future generations. Farmers and other land managers have an essential role to play in managing agricultural soils sustainably. Developers, planners and construction companies must play their part in ensuring soils are adequately protected during development and soil functions are maintained wherever possible. As consumers, we must learn to value our soils more and make informed choices when buying goods, such as compost, to limit our impact.
- 1.10. This Soil Strategy for England builds on and replaces the Soil Action Plan 2004-2006 which was the first time the Government set out its objectives for protecting soils. It sets a long term vision and the strategic goals by which our work on soil protection will be guided. It seeks to provide a clear framework for Defra and its partners, industry and Research Councils, to address the risks relating to our soil. It takes into account achievements to date, sets out the reasons for government intervention and seeks to address barriers to progress. As well as longer term goals it also sets out priorities for action that will contribute towards the achievement of Defra's Public Service Agreements.
- 1.11. Our objectives will be delivered primarily through:
 - **Improving our evidence base:** filling the gaps in our knowledge, particularly in the light of the new challenges soils may face from climate change, and ensuring that policy development is based on the latest scientific information.
 - **Providing information and guidance:** giving those people actively involved in the management of our soils the necessary information or guidance to encourage them to employ best practice in managing soils sustainably.
 - **Using regulation and incentives as drivers for action:** where the need to safeguard public goods is essential or where market failure mean soils are being adversely affected, we will look to regulate potentially damaging activities or incentivise different behaviours.
- 1.12. This is a strategy for England as soil protection policy is a devolved matter. However, many of the pressures on soil are common across the UK and Defra will continue to work closely with the Devolved Administrations to share knowledge and to adopt a coordinated approach where appropriate.

⁸ The Evidence Paper is available at: <http://www.defra.gov.uk/environment/land/soil/index.htm>

Chapter 2: Better protection for agricultural soils

Successfully addressing degradation in agricultural soils is essential to achieving our vision. Farmers, foresters and other land managers are responsible for the management of the majority of our soils. We must work with them to promote good practice and incentivise improved soil management.

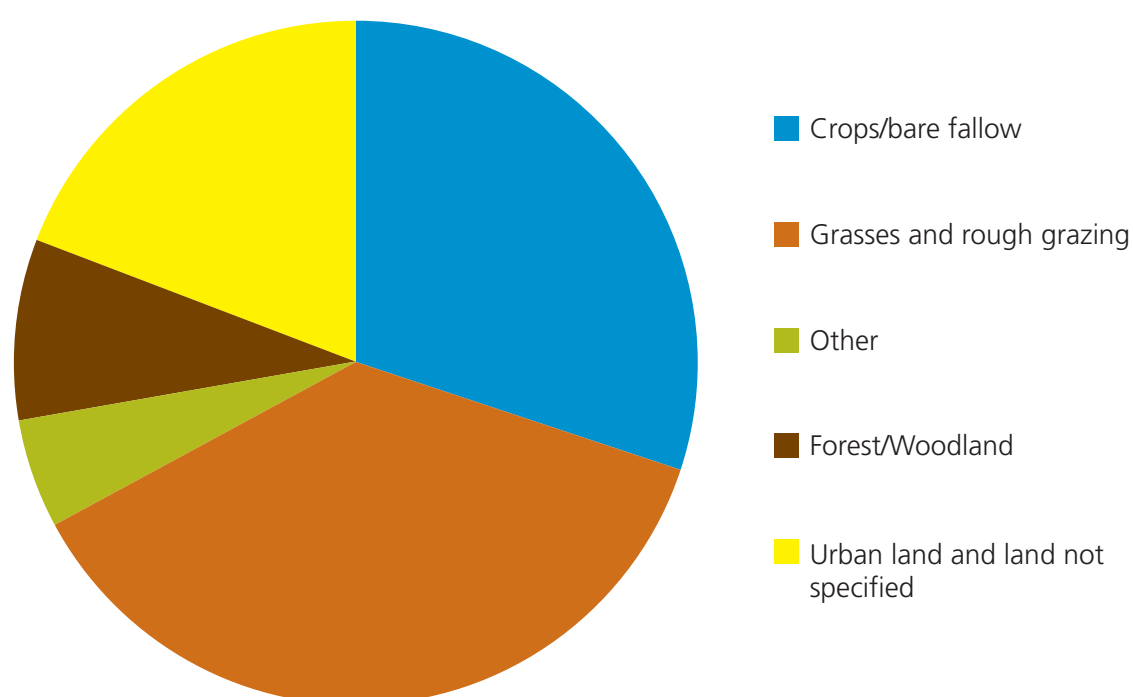
Objectives

- Developing our understanding of the impacts of degradation threats on soil functions and improving our monitoring regime.
- Ensuring that the industry has the necessary skills and knowledge to tackle soil degradation and maintain levels of organic matter.
- Ensuring existing regulatory mechanisms and incentives work effectively to prevent soil degradation.

Background

2.1. Farmers, foresters and other land managers manage approximately 80% of the land in England. Whilst these soils are primarily managed to enhance the production of food and non-food crops (see Figure 2), they also provide a range of other ecosystem services, such as water storage, flood risk management, and support for biodiversity. Many of these soils are facing a number of threats that need to be addressed, including erosion from wind and water, compaction and the loss of organic matter (dealt with in this chapter), and diffuse soil pollution (covered in Chapter 5). There are close links between our work here on soil degradation and our work to protect stores of soil carbon and adapting to climate change (see Chapters 3 and 4 respectively).

Figure 2: Land use in England (2005)



Source: Defra

Chapter 2: Better protection for agricultural soils

- 2.2. This is not a new area of work for Defra. Significant progress has been made in recent years to put in place measures to prevent soil degradation and to provide advice to farmers and land managers (e.g. through CAP cross compliance and the new Code of Good Agricultural Practice). We need to ensure that these measures are working effectively to deliver our objectives and that they are consistent with new evidence and technologies as they become available. We also need to consider other threats to agricultural soils and ensure that these do not become significant problems in the future.

Improving our evidence base

- 2.3. Defra spends approximately £5 million per annum on research on soil and water management. This is supplemented by research carried out by other key funders (Natural England, Environment Agency, Forestry Commission and the Research Councils). Most of Defra's research is focused on developing a better understanding of the threats to soil and what we can do to mitigate the impacts of degradation on soil and the wider environment (e.g. water quality). We will continue to improve our understanding about how degradation affects soil function. Some measures to tackle soil degradation can cause unwanted side effects, such as increased greenhouse gas emissions. Developing best practice which limits these effects will be a priority area of work moving forward.

- 2.4. Defra will continue its programme of research in this area, working in partnership with other research funders. We will:

- in conjunction with the Environment Agency and Natural England carry out a gap analysis of soil research needs;
- assess the impact of soil threats (particularly erosion, compaction and loss of soil organic matter) on soil functions;
- review the current evidence base on soil organic matter, and practices to protect and increase levels;
- carry out further research into practices which have the potential to increase soil organic matter without increasing greenhouse gas emissions or having other negative environmental impacts;
- examine the contribution that soil management can make to flood mitigation; and
- examine techniques for remediating soil physical degradation (including compaction) on grasslands.



Soil erosion caused by runoff

John Quinlan, Lancaster University

Chapter 2: Better protection for agricultural soils

- 2.5. Defra will also work with partners to put in place a system for monitoring the levels and impacts of soil threats. This will look at a range of factors from changes in soil pH to erosion and examine how close our soils may be to critical levels of degradation. This will build on research carried out for the UK Soil Indicators Consortium (see Chapter 8).

Providing information and guidance

- 2.6. We already have in place a number of mechanisms to provide farmers, foresters and other land managers with information and guidance on best practice for managing soils sustainably and to prevent soil degradation. Examples include:

- the revised *Code of Good Agricultural Practice* (published in 2009), which sets out good practice for soil management on the basis of current scientific understanding.
- the England Catchment Sensitive Farming Delivery Initiative, which provides a mechanism for delivering tailored advice to farmers and land managers whose land management activities may impact on surface water in priority areas (e.g. by controlling soil erosion).
- updated *Forest and Soils Guidelines* which support the UK Forestry Standard and explain how to meet soil requirements for the sustainable management of forests and woodlands in the UK.



- 2.7. We need to build on these existing mechanisms to ensure that the industry has the necessary skills and knowledge to tackle soil degradation (particularly erosion, compaction and loss of organic matter). We also need to increase awareness that the best practice for managing soils to protect the environment is often the same as best practice for managing soils for increased productivity. Recent work on promoting organic matter management has shown that some farmers do not always give sufficient consideration to the productivity gains they would get from enhancing organic matter levels, and that more guidance and advice would be helpful.

Chapter 2: Better protection for agricultural soils

2.8. We will:

- provide farmers with tools and advice on maintaining appropriate levels of organic matter, including new guidance on good agricultural practice to protect (and increase) soil organic matter; and
- explore the need for further training and advice to prevent soil degradation, including through agricultural colleges.



Compacted tyre tracks



Runoff and erosion

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Using regulation and incentives as drivers for action

2.9. We already have in place a number of key regulatory mechanisms and incentives to encourage farmers to use and manage their soils sustainably. These include:

- **CAP cross compliance**,⁹ which requires farmers to assess their soil and take actions to address identified problems (the Soil Protection Review and associated measures);
- **Environmental Stewardship**, which includes options that reduce soil erosion from wind and water (including buffer strips);
- **Water Framework Directive measures**, which include measures to prevent soil erosion. The England Catchment Sensitive Farming Delivery Initiative and the potential use of regulation in the form of Water Protection Zones, will help to prevent run-off and the soil erosion it causes. It will be implemented under the River Basin Management Plans which are a requirement of the Water Framework Directive;
- the **UK Forestry Standard**, which identifies the key elements of forest management, including soils, required to qualify for grant aid for woodland creation.

⁹ As part of implementation of cross-compliance, which is a condition for receipt of support under the Common Agricultural Payment, four Good Agricultural and Environmental Condition (GAEC) standards were adopted in January 2005. Their aim is to better protect agricultural soils, focusing on erosion, soil structure and soil organic matter decline.

Chapter 2: Better protection for agricultural soil

2.10. We will ensure that these existing regulatory mechanisms and incentives work effectively to prevent soil degradation and that they are based on the best available evidence. We will also consider whether strengthened regulation or incentives are required to meet our objectives including:

- as part of the review of cross-compliance, introducing a revised Soil Protection Review from January 2010 to make it a more effective tool for soil management and simpler for farmers;
- ensuring that Environmental Stewardship is delivering improved soil protection. We will review the need for future options that provide appropriate levels of soil protection. We will also examine opportunities for further targeting action on key sites, including through enhanced training and information;
- finalising River Basin Management Plans, which include Programmes of Measures, to ensure that the need to protect soils is taken into account as far as possible when addressing risks and pressures on water bodies;
- as part of the Forestry Commission's Review of Grants and Regulation consider whether current targeting of soil protection measures is adequate in the context of climate change; and
- assessing the need for further regulation or incentives to allow us to meet the target under the Sustainable Farming and Food Strategy¹⁰ to halt the decline of soil organic matter caused by agricultural practices in vulnerable soils by 2025.

Summary of initial actions

Objectives	Defra will:
Develop our understanding of the impacts of degradation threats on soil functions and improving our monitoring regime	<ul style="list-style-type: none"> • develop plans for future soil monitoring by 2010 • undertake further research into: <ul style="list-style-type: none"> – best practices to protect and enhance levels of soil organic matter – the contribution of soil management to flood mitigation – best practices to prevent and remediate soil degradation
Ensure that the industry has the necessary skills and knowledge to tackle soil degradation and maintain organic matter	<ul style="list-style-type: none"> • develop guidance on good agricultural practice to protect (and increase) soil organic matter • review training and advice to prevent soil degradation
Ensure existing regulatory mechanisms and incentives work effectively to prevent soil degradation	<ul style="list-style-type: none"> • revise the Soil Protection Review as part of the review of cross compliance to simplify requirements on farmers and improve soil protection • review the need for future options under Environmental Stewardship that provide appropriate levels of soil protection and examine opportunities for further targeting action on key sites by 2010 • Forestry Commission Review of Grants and Regulation will consider whether current targeting of soil protection measures is adequate in the context of climate change

¹⁰ http://statistics.defra.gov.uk/esg/indicators/h5_data.htm

Chapter 3: Protecting and enhancing stores of soil carbon

The size of the soil carbon store means that soils have a vital role to play in climate change mitigation. We must prevent the loss of soil carbon to the atmosphere and explore the potential to increase existing carbon stores as a contribution to meeting the Government's climate change targets.

Objectives

- Improve our understanding of the potential to increase levels of soil carbon.
- Significantly reduce the rate of loss of stored soil carbon by 2020.
- Ensure land managers understand how to reduce emissions and mitigate climate change through improved management practices.

3.1. Soil has an important role to play in climate change mitigation. UK soil stores about 10 billion tonnes of carbon in the form of organic matter. Significant losses of soil carbon would have a major effect on climate change. If all UK soil carbon was lost to the atmosphere this would be equivalent to 36.7 billion tonnes of CO₂ or over 57 times the UK's greenhouse gas emissions in 2007. A 1% loss of soil carbon would be equivalent to the UK's annual fossil fuel emissions. Protecting this carbon store is therefore a priority for this Strategy. *The UK Low Carbon Transition Plan*¹¹ highlights the importance of the UK's soil carbon store and taking steps to protect and enhance it.

3.2. Over half of the UK's soil carbon is within peat habitats, so a key part of our work on mitigating climate change is the protection of peat soils. We already have a number of policies in place to protect peat. The Site of Special Scientific Interest (SSSI) framework gives legal protection to extensive areas of peat habitats, in recognition of their biodiversity and ecosystem value. Defra is seeking to bring 95% of SSSIs into favourable or unfavourable recovering condition by 2010. Around 70% of our peat bog SSSIs meet this target and it is a



A peatland habitat

Defra

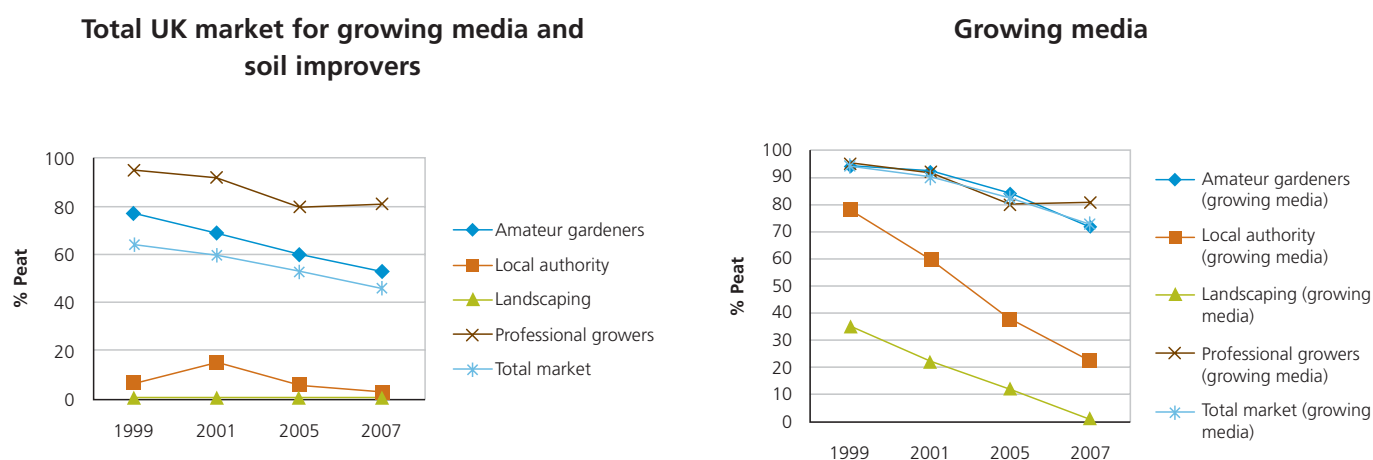
Government priority to improve the condition of the remainder. Peatlands are also addressed under Minerals Planning Guidance 13 which advises minerals planning authorities on the exercise of planning controls over the extraction of peat.

3.3. The UK Biodiversity Action Plan (UK BAP) also provides a framework for the protection of peat and contains many targets on the protection and restoration of peat habitats. These complement targets for SSSI condition but also include a commitment to increase the areas of peat-forming habitats and improve condition of undesignated peatland habitats. Another such target for lowland raised bogs is for 90% of the total UK market for composts and other growing media to be peat free by 2010.

¹¹ *UK Low Carbon Transition Plan White Paper: National Strategy for Climate and Energy*. (HM Government, July 2009). Available from: www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

Chapter 3: Protecting and enhancing stores of soil carbon

Figure 3: Proportion of peat used by different sectors in 2007



Source: ADAS and Enviro (2008), *Monitoring of peat and alternative products for growing media and soil improvers in the UK 2007*.

- 3.4. A multi-agency project, the Partnership Project on Peat,¹² has been set up to take forward our work on peat. This is focused on achieving a range of environmental objectives including climate change mitigation. There are two planned phases. The first, running until the end of 2009, involves developing the current evidence base, reviewing the policy framework and making broad policy recommendations. The second, due to begin in 2010, will involve refining potential policy measures and then moving towards their implementation.

Improving our evidence base

- 3.5. A robust evidence base is needed to underpin the development of policies and measures to protect soil carbon. We need better evidence on trends in soil carbon concentrations and on cost-effective techniques for protecting or increasing levels of soil carbon and protecting, managing and restoring peatlands.
- 3.6. In 2006 Defra ran expert workshops to determine the significant gaps in our knowledge of soil carbon. As a result, Defra commissioned work to:
- improve the integration of data to obtain a better idea of the state of our carbon stocks and the processes that affect them;
 - develop a better understanding of steps that can be taken to protect or enhance levels of soil carbon; and
 - determine the potential for sequestering carbon in soils.
- 3.7. There have been two large scale national surveys which have monitored changes in soil carbon over time. One found a serious decline in levels of soil carbon in England and Wales between the late 1970s and 2003. The other shows no significant changes in soil carbon in Great Britain between 1978 and 2007. Therefore, trends in soil carbon concentrations remain unclear, and we will continue to focus on understanding this issue better.

¹² The project involves central Government departments, Devolved Administration and statutory agencies. For more details, see: <http://defra.gov.uk/environment/land/soil/peat/partnership-project.htm>

Chapter 3: Protecting and enhancing stores of soil carbon

- 3.8. In addition to the uncertainties over trends in soil carbon, there are a range of other issues that we need to address. We need to develop cost-effective methods for protecting and increasing soil carbon without increasing emissions of other greenhouse gases, including giving consideration to emerging technologies such as biochar. We also need to explore opportunities for peat restoration which do not lead to carbon benefits being negated by disproportionate increases in methane emissions.
- 3.9. Defra will continue its programme of research in this area, working in partnership with other research funders. We will:
- resolve the differences in trends of soil carbon and identify the magnitude and causes of any decline;
 - develop a simple tool to predict carbon fluxes from changes in land use and land management;
 - consider the viability of the use of developing technologies as cost-effective means of mitigating climate change;
 - identify steps that can be taken to protect and enhance soil carbon (including peat) whilst minimising greenhouse gas emissions;
 - understand the greenhouse gas fluxes of peatlands in different conditions and the effect of restoration;
 - assess the economic value of the broad range of ecosystem services provided by peat, including climate regulation;
 - coordinate with the UK Greenhouse Gas Inventory prepared by the Department of Energy and Climate Change so that this information can be used in preparing the UK's greenhouse gas estimates for international and domestic reporting.

Providing information and guidance

- 3.10. To date most of Defra's work on providing information and guidance on soil carbon has focused on maintaining organic matter in agricultural soils. This will continue to be a key focus of the strategy (see Chapter 2).
- 3.11. As the evidence base develops we will also provide advice and guidance on land management practices to protect or increase stores of soil carbon, and on best practice for peat restoration and management. This will build on existing advice and will be developed with partners such as Natural England, the Environment Agency and the Forestry Commission.
- 3.12. Defra will work with partners and other stakeholders, including through the Partnership Project on Peat to:
- develop and provide information on best practice for the restoration and management of peat. We will also consider whether further measures are required to support this;
 - encourage good practice in heather and grass burning through the promotion of the revised (2007) Heather and Grass Burning Code; and
 - encourage good practice on common land, including through Commons Councils,¹³ particularly where they are established in the uplands, to improve the protection of moorland habitats and peat soils.

¹³ Common Councils are being set up under the Commons Act 2006 to ensure the improved management of agriculture on common land.

Chapter 3: Protecting and enhancing stores of soil carbon

Using regulation and incentives as drivers for action

3.13. Regulatory measures and incentives are also required to protect soil carbon. There are a number of such measures already in place and we will ensure they work effectively to protect soil carbon. We will also consider what further measures are required to meet our objectives particularly in relation to peat protection.

3.14. Although our scientific understanding of overall trends in soil carbon may still be unclear we must do all we can to ensure that the existing carbon store is protected. So that all future policy development on soils is guided by the need to protect our existing carbon stores, this Strategy establishes a new high level goal of significantly reducing the rate of loss of soil carbon by 2020.



Gully blocking on peat

Defra

3.15. To support this new goal Defra will:

- evaluate whether cross compliance and Environmental Stewardship can make a greater contribution to reduce carbon emissions;
- work through the Partnership Project on Peat to develop measures for the restoration and prevention of degradation of peat by 2010;
- develop an appropriate framework for action beyond 2010 to further reduce the horticultural use of peat; and
- provide support to planners to enable them to take into account soil carbon losses or gains resulting from land use change.

Summary of initial actions

Objectives	Defra will:
Improve our understanding of the potential to increase levels of soil carbon and protecting our current stores	<ul style="list-style-type: none">• undertake further research into:<ul style="list-style-type: none">– trends in soil carbon– management practices to protect and enhance carbon storage in soils– greenhouse gas fluxes, especially methane fluxes, from a range of peat soils pre- and post-restoration– the value of the broad range of ecosystem services provided by peat soils
Significantly reduce the rate of loss of stored soil carbon by 2020 Ensure land managers understand how to reduce emissions and mitigate climate change through improved management practices	<ul style="list-style-type: none">• consider the contribution that cross-compliance and Environmental Stewardship can make to reduce carbon emissions (see chapter 2)• work with partners through the Partnership Project on Peat to develop further measures for the restoration and prevention of degradation of peat by 2010• develop an appropriate framework for action beyond 2010 to reduce the horticultural use of peat• encourage good practice in heather and grass burning through the promotion of the revised Heather and Grass Burning Code

Chapter 4: Building the resilience of soils to a changing climate

A changing climate provides the context in which this strategy must operate. Achieving our vision relies on the ability to better understand the impact of climate change on our soils and identify what must be done to enable them to adapt.

Objectives

- Develop the evidence base on the impact of climate change on soils.
- Ensure that land managers have the information and guidance necessary to be able to secure the resilience of their soils in the face of a changing climate.

Background

- 4.1. The latest UK Climate Projections 2009¹⁴ show that as a result of climate change the UK is likely to see hotter drier summers and warmer wetter winters, coupled with increased frequency of extreme weather occurrences such as heatwaves, dry spells, heavy rain and flooding as well as rises in sea level.
- 4.2. This will present both opportunities and challenges for soils. A warmer, wetter climate, and changes in rainfall patterns, will allow different crops to be grown, increase yields and may increase rates of sequestration. But more common extreme weather events and rises in sea level have the potential to have a significant effect on our soils and increase the risk of degradation. The costs of erosion, compaction and organic matter decline are already over £100m a year, including from lost production, and could rise unless we are able to adapt management practices to our changing climate.
- 4.3. Improving our understanding of how climate change will affect our soils will be essential in allowing us to adapt to the changes we are likely to see. It will enable us to tailor the policies and advice tools set out in this Strategy to ensure that land managers have the appropriate knowledge and skills and can adapt their practices. The earlier we start adapting to the impacts of climate change, the better equipped we will be to cope with future changes.

Improving our evidence base

- 4.4. There have been very few climate change impact studies directly focused on soils or soil functions. Defra's review of the available literature (published in 2005) showed that where soils had been considered the focus had been on only a few soil parameters, such as carbon, and was mostly limited to the use of soils for growing crops.¹⁵
- 4.5. More recently, Defra has commissioned research to explore how soil threats such as erosion, compaction and organic matter decline, are likely to be affected by climate change. This research will use soil threat models and the new UK Climate Projections to model climate change impacts.

¹⁴ Defra (2009), *Adapting to Climate Change: UK Climate Projections*.

¹⁵ Bradley et al (2005) *Impacts of Climate Change on Soil Functions*. Defra project SP0538.

Chapter 4: Building the resilience of soils to a changing climate

- 4.6. Defra is also examining the significant contribution that the natural environment, including soil, can make in supporting wider adaptation of the economy and society to climate change. Defra's Natural Environment – Adapting to Climate Change project will report in March 2010 and will deliver a strategic overview of what is currently known about the impacts of climate change on the natural environment, setting out current and planned measures to address them. It will also produce a clear framework aimed at adapting the natural environment in England.
- 4.7. Defra will continue its programme of research on climate change impacts on soil, working in partnership with other research funders. We will:
- build on research already commissioned which uses the new UK Climate Projections 2009 to model the impact of climate change on soil threats (reporting in 2010);
 - explore the impacts of climate change on urban soils, soil biota and soil functionality; and
 - explore the impacts of climate change on peat soils and habitats.

Providing information and guidance

- 4.8. As our understanding of the impacts of climate change on soils develops, we will work with the agriculture and land management sectors to understand how soil management practices may need to change to adapt to climate change and to make soils more resilient to change. We will identify the best advice tools to encourage farmers to change their practices and ensure that soil protection guidance is amended to reflect new knowledge.
- 4.9. Defra will continue to work, in collaboration with the Rural Climate Change Forum and through initiatives such as Farming Futures, to inform the sector of the likely risks and to promote and encourage sustainable adaptation and mitigation by farmers, foresters and land managers.
- 4.10. Defra will also continue to work with Communities and Local Government (CLG) and the Department for Business, Innovation and Skills (BIS) to ensure that planning authorities, developers and the construction industry have the necessary information and tools to enable them to take account of the impacts of climate change on soil, in decision making and during the construction process. We will:
- assess how the planning system should take account of the impacts of climate change on soils in plan making and development control; and
 - examine whether guidance is required on how soils should be managed during construction in light of climate change.



Dry cracked soil

Defra Photo Library

Chapter 4: Building the resilience of soils to a changing climate

Using regulation and incentives as drivers for action

4.11. Defra will explore how cross compliance and Environmental Stewardship programmes (see chapter 2) can be used to encourage adaptation. We will review cross compliance measures and guidance to ensure they take full account of new evidence on climate change impacts and adaptation.

Summary of initial actions

Objectives	Defra will:
Develop our evidence base on the impact of climate change on soils	<ul style="list-style-type: none">• undertake further research into:<ul style="list-style-type: none">– the impact of climate change on soil, soil functions and soil threats– the impact of climate change on peat soils and habitats
Ensure land managers have the information and guidance necessary to be able to ensure the resilience of their soils in the face of a changing climate	<ul style="list-style-type: none">• periodically review cross-compliance soil protection measures and guidance to update them based on new evidence on climate change adaptation (see chapter 2)• review new guidance on how soils should be managed during construction by 2012 (see chapter 6), including consideration of whether additional guidance is needed to take account of climate change impacts

Soil pollution has long-term implications for soil quality, and pollutants enter the soil from many sources. Achieving our vision relies on preventing the pollution or contamination of our soils, in particular from the spreading of organic and inorganic materials to land and from atmospheric deposition.

Objectives

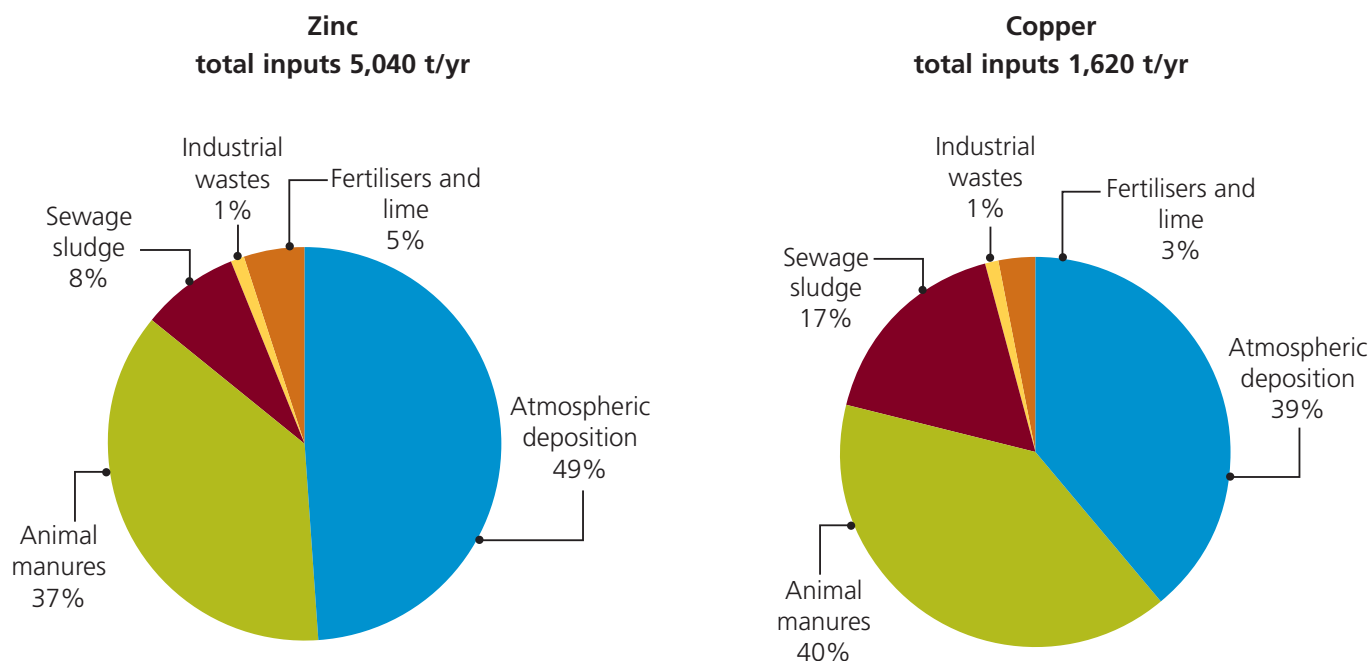
- Improve our understanding of the risks to human health and the environment from soil pollution.
- Reduce the levels of pollutants entering the soil from the atmosphere and from materials spread to land.
- Ensure advice on the use of materials spread to land reflects the latest scientific understanding.

Background

- 5.1. The gradual build up of pollutants in soil over many decades is a serious threat to soil functions. The presence of pollutants can adversely affect soil biota that are necessary for a healthy functioning soil, as well as plants and other animals. Soil pollutants also have the potential to adversely affect human health if they enter into the food chain or drinking water sources. This chapter focuses on diffuse soil pollution in particular from atmospheric deposition and the spreading of materials to land. Dealing with our historic legacy of contaminated land is dealt with in chapter 7.
- 5.2. Atmospheric deposition resulting from industrial processes and agriculture can be a significant source of polluting substances such as heavy metals, nutrients and other acidifying substances. Over the last 25 years an effective regulatory framework for controlling emissions of pollutants to the atmosphere has been put in place. This has directly led to a reduction in levels of atmospheric deposition of pollutants to soil.¹⁶ However, soils in some areas of England remain at risk of acidification and eutrophication caused by atmospheric deposition.
- 5.3. Spreading organic (e.g. composts, manure, sewage sludge) and inorganic materials (e.g. recycled gypsum from waste plasterboard) materials to land is an important part of increasing levels of organic matter in soil, reducing fertiliser requirements and diverting materials from landfill. It can have important agricultural and ecological benefits. However, on occasion, these materials can also contain low concentrations of pollutants, especially heavy metals, which can accumulate in soil following repeated applications (see Figure 4). This could pose a risk to human health and the environment. Remediating soils which contain pollutants is difficult and expensive and so action must focus on preventing unacceptable levels of pollutants entering soil in this way.

Chapter 5: Preventing soil pollution

Figure 4: Total annual inputs (t/yr) of zinc and copper to agricultural soils in England and Wales



Source: Nicholson *et al* (2007), *Sources and impacts of past, current and future contamination of soil*. Defra Project SP0547

Improving our evidence base

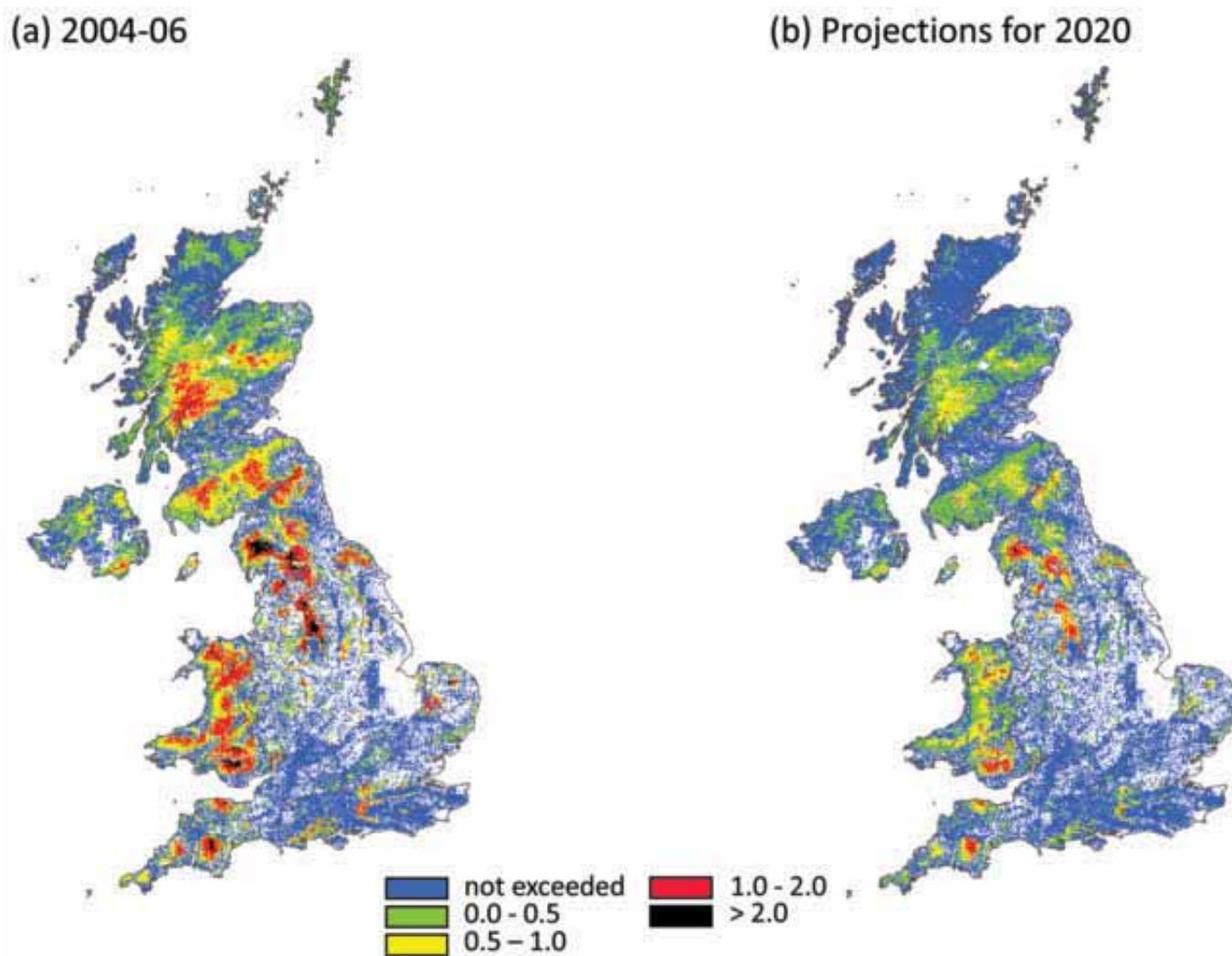
- 5.4. Defra has been carrying out a large programme of research to better understand the risk of soil pollution. A recent review of the available evidence on the sources and impacts of past, current and future soil pollution suggests that most sources of soil pollution are suitably controlled.¹⁶ However, it highlighted the need to look again at the heavy metal loading of soil and the more recent trend to spread sorted and appropriately treated organic and inorganic materials diverted from landfill to land that can contribute to this. Other recent research indicates that more work is needed to examine the levels of metals in soil and their sources and the increasing significance of ammonia emissions.¹⁷
- 5.5. Atmospheric heavy metal deposition to soil is strongly influenced by rainfall, and is highest in the mountainous areas in the North and West of the UK. Over half of the managed broadleaved woodland and unmanaged woodland in the UK exceed set thresholds for metals as well as for acidity and nutrient nitrogen. Defra funds the Acid Deposition Monitoring Network, and modelling studies to assess the levels of sulphur and nitrogen deposition across the UK. Due to environmental regulation in the UK, and across Europe, industrial emissions have declined and deposition of sulphur has substantially decreased, leading to a subsequent reduction in the acidity of soil that is projected to continue (see Figure 5). At the same time nitrogen deposition has only shown a small decrease.

¹⁶ Further details can be found in the Evidence paper that accompanies the Strategy online at: <http://www.defra.gov.uk/environment/land/soil/index.htm>

¹⁷ Nicholson *et al* (2007), *Sources and impacts of past, current and future contamination of soil*. Defra Project SP0547.

- 5.6. Whilst overall there has been good progress in reducing pollutant deposition, there is still a significant amount of improvement needed before the issue is completely addressed.

Figure 5: Critical load exceedances for acidity by acid deposition



Source: Centre for Ecology and Hydrology (CEH).

Chapter 5: Preventing soil pollution

- 5.7. Defra will continue its programme of research in this area, working in partnership with other research funders. We will:
- continue to monitor trends in diffuse soil pollution;
 - identify levels of pollution which present an unacceptable risk to human health and the environment, and examine the links between pollutant concentrations in soil and the presence of pollutants in food and water;
 - investigate further how pollution affects soil functions and what more can be done to reduce the pollutants contained in recycled materials;
 - work with the Environment Agency to develop soil metal limits which will be applicable to the return of all materials to land and examine the impact of changing current limits. This will make use of tools such as the Agricultural Heavy Metal Inventory¹⁸ and ALLOWANCE;¹⁹
 - improve our understanding of the impacts of atmospheric deposition of pollutants on biodiversity and ecosystems, including soil communities, and the ability of soils to recover as levels of pollution from some sources decline; and
 - continue to review the need for controls on any new or emerging substances which enter soil, including nanoparticles.
- 5.8. Defra is currently reviewing the data available on transboundary air pollutants and their contribution to acidification, eutrophication, ground level ozone and heavy metal deposition in the UK. The Review of Transboundary Air Pollution²⁰ (RoTAP) is out for consultation and will be published in Spring 2010.

Providing information and guidance

- 5.9. There is considerable advice and guidance available at present on the recycling of organic and inorganic materials to land. This is in the form of codes of practice, safe use matrices and Quality Protocols.²¹ These aim to provide users with confidence in the use of these materials as well as ensuring that their use does not have a negative impact on the environment.
- 5.10. As the quantity and range of materials recycled to land increases, farmers, foresters and other land managers require additional information on the best use of these materials and reassurance that their use will be beneficial. Defra needs to ensure that farmers, foresters and land managers have this information if we are to realise the benefits of using these materials, including maintaining levels of organic matter in soils.
- 5.11. As our evidence base develops and new information becomes available, Defra will work with the agriculture, land management and waste sectors to ensure existing advice on the use of these materials remains up to date, and provide new advice where necessary.



18 The Agricultural Heavy Metal Inventory calculates the levels of metals entering soils from different sources. The most recent update is in Defra project SP0547.

19 ALLOWANCE is a tool which is being developed to provide a better understanding of the national capacity of agricultural land to accept organic materials. Defra project ES0128: *Agricultural Land and Organic Waste - A National Capacity Estimator (ALLOWANCE)*.

20 See <http://www.rotap.ceh.ac.uk/home>.

21 Quality Protocols give guidance on how to recover waste and remove it from the waste regulatory regime. For further information see: <http://www.environment-agency.gov.uk/business/topics/waste/32154.aspx>

Using regulation and incentives as drivers for action

- 5.12. There is an extensive EU and domestic legislative framework in place to prevent the introduction of pollutants to soil through addressing industrial emissions and ensuring that recycling materials to land does not present unacceptable risks to human health and the wider environment. As our evidence base develops, and as new materials are proposed for recycling to land, we need to keep these regulations and associated standards under review.
- 5.13. The UK has also entered into several international agreements aimed at addressing long range air pollution.²² As these agreements come up for review the UK will play an active part in negotiations to ensure they continue to address industrial emissions and further limit the potential for pollutants entering soil through atmospheric deposition. At EU level, the Commission are expected to put forward proposals for the revision of the National Emission Ceilings (NEC) Directive in late 2009/early 2010.



Environment Agency

Injection of slurry to reduce ammonia emissions

²² The Convention on Long Range Transboundary Air Pollution (including protocols on Persistent Organic Pollutants (POPs) and Heavy Metals) and the United Nations Economic Commission for Europe (UNECE) Gothenburg Protocol to abate acidification, eutrophication and ground level ozone.

Chapter 5: Preventing soil pollution

5.14. Defra will:

- review existing thresholds for metals and other pollutants in soils and identify how the levels of pollutants present in materials spread to land can be reduced;
- continue working with the Environment Agency, the Waste and Resources Action Programme (WRAP) and industry partners to develop standards and quality protocols for further materials which could be spread to land. Forthcoming protocols will cover the production and use of products from the anaerobic digestion of source-segregated waste and gypsum from waste plasterboard;
- ensure that regimes such as Environmental Permitting encourage the return of beneficial organic materials to soil, whilst making certain that this does not lead to significantly increased diffused soil pollution;
- implement the review of the waste exemptions from Environmental Permitting by April 2010 to provide a more risk based and proportionate approach to the regulation of waste recovery and disposal operations;
- ensure that the discussions at European level on any further revision of the Sewage Sludge Directive and the possible Biowaste Directive are informed by the developing UK evidence base in this area; and
- use reviews of international agreements on long range air pollution to further Defra's objectives on atmospheric deposition.

Summary of initial actions

Objectives	Defra will:
Improve understanding of the risks to human health and the environment from soil pollution	Undertake research to: <ul style="list-style-type: none">• continue to monitor trends in diffuse soil pollution• examine links between pollutant concentrations and impacts on soil quality• investigate the potential for reducing pollutants contained in materials being recycled to land• improve our understanding of the impact of atmospheric deposition of pollutants on biodiversity and ecosystems and the potential for recovery as this deposition declines• publish the Review of Transboundary Air Pollution in Spring 2010
Reduce the levels of pollutants entering the soil from the atmosphere and materials spread to land	<ul style="list-style-type: none">• review existing thresholds for heavy metals• identify the sources of metals from different waste streams and how concentrations can be reduced by 2010
Ensure advice on the use of materials spread to land reflects the latest scientific understanding	<ul style="list-style-type: none">• as our evidence base develops, ensure existing advice on the use of materials remains up to date and provide new advice where necessary

Chapter 6: Effective soil protection during construction and development

Good quality soils in urban areas are vital in supporting ecosystems, facilitating drainage and providing urban green spaces for communities. Ensuring these functions are sufficiently understood and valued in the planning system and during construction is an essential part of achieving our vision.

Objectives

- Ensure soil ecosystem services are fully valued in the planning process.
- Ensure appropriate consideration is given to the protection of good quality agricultural soils from development.
- Encourage better management of soils through all stages of construction.

Background

6.1 Our land and soils are subject to many competing demands and increasing pressures (e.g. for new housing). If not managed carefully, land use changes due to development (including infrastructure, commercial and residential and mineral extraction) can lead to losses of soil (soil sealing) and soil functions. Poor construction practices during development can also lead to further soil degradation (e.g. compaction and pollution).

6.2. Some degree of soil sealing is an unavoidable consequence of development. The planning system provides a framework within which consideration can be given to the environmental, economic and social costs and benefits of the development and use of land. The planning system is also increasingly recognising the importance of mitigating the impacts of soil sealing, particularly in relation to urban drainage and maintaining green infrastructure.



Defra

6.3. To protect greenfield sites from development the Government has put in place a target for 60% of new homes to be built on brownfield sites by 2020. This is currently being exceeded, with 75% of homes built on brownfield land. Environmental Impact Assessments are also required on major projects and Sustainability Appraisal, mandatory under the Planning and Compulsory Purchase Act 2004, has been introduced to promote sustainable development into the preparation of revisions of Regional Spatial Strategies (RSS) and for new or revised Development Plan Documents (DPD) and Supplementary Planning Documents (SPD).

Chapter 6: Effective soil protection during construction and development

- 6.4. During construction, soils can be compacted through machinery use and are at risk of erosion when left exposed to wind and rain. Compacted soils in urban areas can increase run off and the risk of surface water flooding. Urban soils are often contaminated with building waste materials, harming their ability to function properly and support urban biodiversity and ecosystems. This contamination can also mean soils with other materials in them cannot be re-used on site and must be disposed of appropriately.
- 6.5. More generally, Defra has begun work to take a long-term view of all types of land use in England. It will look ahead to 2050 and beyond and identify the policy tools and levers needed to optimise our use and management of land. The major component of this work is an independent study by Foresight,²³ the Land Use Futures Project, to analyse future land use challenges through looking at pressures and trends and developing scenarios and models. This will consider soil issues, including carbon stores.

Improving our evidence base

- 6.6. Over recent years Defra has developed its evidence base on the impact of construction and development on soil functions. This has shown that construction can lead to significant local soil degradation and soil is often not considered until the landscaping phase of a project by which time most of the damage has already been done.
- 6.7. With increasing pressures on our soils from climate change and competition for land expected in future, Defra needs to continue its programme of research in this area, working in partnership with other research funders. We will:
- investigate the impacts of climate change on soils in the urban environment and develop adaptation strategies; and
 - examine patterns of soil loss and understand the risks to agricultural land from development pressures.

Providing information and guidance

- 6.8. The planning system seeks to ensure that we get the right development, in the right place, at the right time. It provides a framework for sustainable development including the sustainable use of soils. It should facilitate and promote sustainable and inclusive patterns of urban and rural development, which includes making suitable land available for development in line with economic, social and environmental objectives, whilst protecting and enhancing the natural environment, the quality and character of the countryside, and existing communities. The presence of best and most versatile agricultural land is a material consideration in planning decisions, but has to be taken into account alongside other sustainability considerations including: biodiversity, the quality and character of the landscape, accessibility to infrastructure, workforce and markets and maintaining viable communities.
- 6.9. The level of protection afforded to soil is therefore dependent on how planning policies are implemented and the relative weight given to it in a particular area. We need to ensure that those developing and implementing planning policy have the tools and skills to allow them to give appropriate consideration to soils.

²³ <http://www.foresight.gov.uk/OurWork/ActiveProjects/LandUse/LandUse.asp>

Chapter 6: Effective soil protection during construction and development

- 6.10. Soil protection is mentioned in a number of Planning Policy Statements (PPSs) – notably in PPS1 (Delivering Sustainable Development) and its Supplement on Climate Change and in PPS11 (Regional Spatial Strategies), as well as in the Strategic Environmental Assessment and Environmental Impact Assessment Directives. Defra will continue to work with Communities and Local Government (CLG) to ensure that local planning authorities have sufficient guidance and information on soils to take effective decisions at the local level. This will include developing a new toolkit to provide simple, practical information to regional planning bodies and local planning authorities on how they should take soil and its functions into account at the local level.



Defra

Lincoln's Inn Fields, London

Urban green spaces, such as parks, are important areas that need to be valued for the many services they provide. In addition to their many social benefits, green spaces support biodiversity, absorb rainwater thereby improving drainage, control pollution, regulate urban temperatures, reduce noise pollution and can be used by local communities to grow food. These services all rely on good soil quality.

- 6.11. We will also ensure that sufficient information and guidance on soils is available to help with carrying out Strategic Environmental Assessments and Environmental Impact Assessments.²⁴ Defra will provide guidance about the soil information needed to undertake these assessments at regional, local and site level, and information to assist with considering the impact of plans, programmes and individual development projects on soil functions.
- 6.12. A joint Defra, Department for Business, Innovation and Skills (BIS) and WRAP *Construction Code of Practice for the Sustainable Use of Soils on Construction Sites* is being published alongside this Strategy and we will work together to disseminate it and ensure that it becomes part of wider industry best practice. The Code aims to improve the use and management of soils through all stages of the construction process including reusing or recycling topsoil where appropriate.

Using regulation and incentives as drivers for action

- 6.13. Current planning policies provide a framework for the sustainable use, management and restoration of soils. Defra will continue to work with CLG to ensure that they are effectively implemented. We will also ensure that as planning policy develops it continues to provide effective protection of soils, for this and future generations.

²⁴ The European Directives on Strategic Environmental Assessment of plans and programmes and Environmental Impact Assessment of projects both require consideration of the likely environmental effects on soils.

Chapter 6: Effective soil protection during construction and development

- 6.14. Defra and CLG will review the weight that should be given to protecting good quality agricultural soils from development. Planning policy on agricultural land requires local planning authorities to take account of the presence of best and most versatile agricultural land (BMV) (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) alongside other sustainability considerations (e.g. biodiversity and the quality and character of the landscape) when determining planning applications. We will also work together to review the effectiveness of the existing planning policy to protect soils and consider whether there is a need to update the policy.
- 6.15. As part of our efforts to prevent surface water flooding from rainfall Defra will also maintain its commitment to improving drainage in urban areas building on planning policy in Planning Policy Statement 25, and the measures set out in the draft Floods and Water Bill to facilitate the use of sustainable drainage systems. We will also continue to look for further opportunities to ensure that when development takes place key soil functions including drainage can be retained.

Summary of initial actions

Objectives	Defra will:
Ensure soil ecosystem services are fully valued in the planning process Ensure appropriate consideration is given to the protection of good quality agricultural soils from development	<ul style="list-style-type: none">• develop a new toolkit for local authorities to enable them to take account of soil functions, including soil carbon, more effectively through the planning system by 2010• work with CLG to review the effectiveness of the existing planning policy to protect important soils and whether there is a need to update the policy• take forward actions agreed as part of the Foresight Land Use Futures Project as appropriate, when it concludes in 2010
Encourage better management of soils through all stages of the construction process	<ul style="list-style-type: none">• publish code of practice for soil use on construction sites and work with CLG to encourage the construction industry and local authorities to use it• with CLG monitor uptake of the code of practice and if necessary review in 2012

Chapter 7: Dealing with our legacy of contaminated land

Contaminated soils can pose a significant risk to human health and the environment. To achieve our vision we need to ensure these risks are identified and dealt with. The scale of the task means this is likely to take decades to achieve.

Objectives

- Improve understanding of the impacts of contaminated land and sustainable remediation techniques.
- Ensure contaminated sites that pose a significant risk to human health and the environment are identified and steady progress is made towards their remediation.

Background



Contaminated lagoon

7.1. England has a substantial legacy of chemical contaminants in soils resulting from our industrial heritage. Thousands of different substances might be involved, depending on the history of any individual site (see Figure 6). More common types of substances include heavy metals (e.g. lead, cadmium and arsenic), solvents, other hazardous hydrocarbons (e.g. oils and tars, persistent organic pollutants, poly-aromatic hydrocarbons, landfill gas) and asbestos.

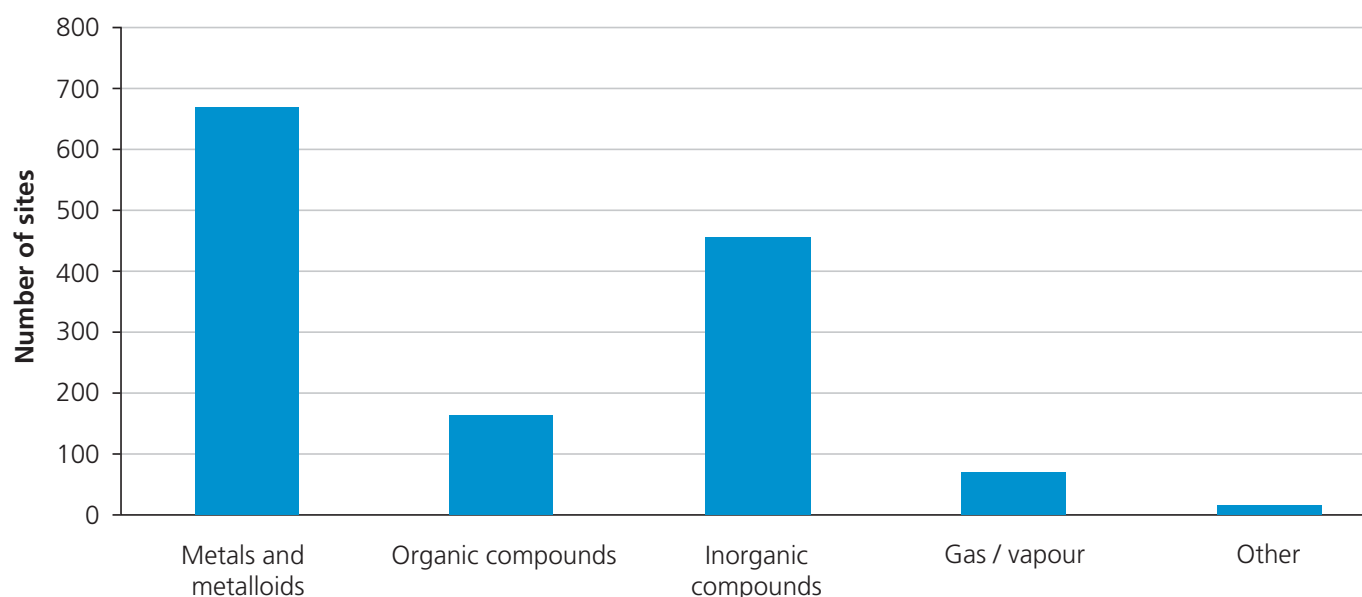
Defra

- 7.2. The types of site which may pose a significant risk are very varied. The two most common types of sites are (i) industrial land, such as old gas works, chemical plants, oil refineries, petrol stations, metal works, and munitions factories; and (ii) former landfills, and waste handling and disposal facilities.
- 7.3. The Government's primary interest lies in ensuring that significant risks to human health are addressed. Our policy usually deals with longer-term risks, particularly chronic effects of prolonged exposure to contaminants through regular ingestion, inhalation or skin contact with substances over many years. We also want to address significant risks to the environment. In particular, it is important to address cases where soil contamination may lead to the pollution of water resources (as can happen if substances leach into rivers or groundwater). In addition there are other potential environmental effects, including risks to soil health, ecosystems, property, livestock and crops.

Chapter 7: Dealing with our legacy of contaminated land

- 7.4. In some cases our policy may be dealing with active risks (e.g. if houses have been built on a contaminated site, or if water resources are being polluted). In other cases, we may be looking to guard against potential problems in the future (e.g. if a developer wants to build houses on a ex-industrial site, or if substances are migrating towards a river).

Figure 6: Main contaminants at reported contaminated land sites in England and Wales 2007



Source: Environment Agency

- 7.5. It is important to identify and deal with contaminated land in a way which is proportionate and both environmentally and economically sustainable. The process of remediating contaminated land often involves heavy engineering works which itself causes environmental and social impacts, and which tend to be expensive. So benefits need to be weighed carefully against impacts.

Improving our evidence base

- 7.6. Defra needs a robust evidence base to underpin further developments of contaminated land policy. Whilst there is already quite a large body of research in this area, further evidence is required, particularly on the impacts of contaminated land and on more sustainable remediation techniques.
- 7.7. Defra will continue its programme of research in this area, working in partnership with other research funders. We will:
- improve our understanding of the risks posed by contaminated land to human health and the environment;
 - assess remediation techniques, looking at social, environmental and economic costs and benefits;
 - improve our knowledge of how much contaminated land is being dealt with under the planning system, as brownfield land is redeveloped;

Chapter 7: Dealing with our legacy of contaminated land

- build on international best practice in finding and remediating contaminated sites; and
- identify priorities for the development of skills within the contaminated land sector.

Providing information and guidance

- 7.8. There is a large amount of advice and guidance available on identifying and remediating contaminated land, produced by various organisations including the Environment Agency.
- 7.9. In recent years there has been uncertainty about how Local Authorities should decide when land contamination poses a *significant possibility of significant harm* (the main legal trigger point for when a site qualifies as contaminated land). Defra provided greater clarity with the publication in July 2008 of Guidance on the Legal Definition of Contaminated Land. This guidance explained why contaminated land legislation devolves decisions over what qualifies as “significant” to be taken case-by-case by Local Authorities, and how they should go about taking decisions.
- 7.10. To build on the 2008 guidance, Defra is preparing new guidance to help Local Authorities make proportionate and robust decisions under contaminated land legislation due for publication later this year. The new guidance will go step-by-step through the decision making process.

Using regulation and incentives as drivers for action

- 7.11. Since the mid-1990s, various measures have been introduced to address land contamination. The main measures are the planning system which controls how contamination is addressed when sites are redeveloped (for example through planning conditions); contaminated land legislation (Part 2A of the Environmental Protection Act 1990); and fiscal incentives. In addition, land owners may choose to remediate land themselves, for example to increase its market value and to reduce potential liabilities.
- 7.12. Planning policy (as set out in Planning Policy Statement 23) requires that land which may be affected by contamination is assessed and, where necessary, remediated to ensure it is suitable for its proposed new use. Planning policy also encourages development of brownfield sites which are often affected by some degree of contamination.
- 7.13. Part 2A of the Environmental Protection Act 1990, which came into force in 2000, requires Local Authorities to identify contaminated land in their areas, ensure it is remediated, and make the “polluter” pay wherever possible. Part 2A is primarily intended to be used only where the “market” does not provide a solution. Part 2A also plays an important indirect role by encouraging market solutions (i.e. the presence of legislation which could force action often provides a strong incentive for polluters and landowners to take action voluntarily).
- 7.14. The Government also uses various other measures. For example:
- Defra’s Contaminated Land Capital Projects Programme provides grants to Local Authorities to identify and remediate contaminated land. The programme is worth up to £17.5 million in 2009/10;
 - the Environment Agency has a £2.45 million capital programme to deal with special sites under Part 2A (e.g. where water pollution is occurring);

Dealing with our legacy of contaminated land

- since 2001, owners of contaminated land have been able to claim Corporation Tax “land remediation relief” of money spent removing contamination;
- the Homes and Communities Agency undertakes the remediation of brownfield land to prepare it for redevelopment; and
- contaminated land is often cleaned-up as part of wider regeneration projects, for example at the Olympics 2012 site and through the National Coalfields Programme.

7.15. Our policy is based on the idea that wherever possible we should encourage the “market” to deal with land contamination, and hold other measures in reserve to deal with cases where there is no prospect of a private sector solution. This ensures that land where possible is remediated during ongoing redevelopment of brownfield sites for other uses and therefore occurs at a much lower cost. Public sector funds are then focused on those sites which are unable to be addressed in this way.

7.16. For contaminated sites where there has been a market solution, remediation has been booming over the last decade, driven by the buoyant property market, legislation and incentives. The recent downturn in the property market has reduced the amount of this remediation, but it is likely to increase again as the property market recovers. The Government will continue to encourage the use of market solutions through the various measures mentioned above.

7.17. Local Authorities have already put in place systems for dealing with contaminated land. Defra will continue to encourage action by Local Authorities, particularly for sites for which there is no market solution. For example, we will improve guidance on how to make robust decisions, and provide grants to help pay for work. We will encourage Local Authorities to prioritise those sites which pose the greatest risk to human health and the environment.

7.18. Defra is also keen to promote the use of sustainable remediation wherever possible. In the past, the contaminated land sector has tended to rely primarily on heavy engineering solutions. These techniques usually offer relatively quick-fix solutions but can be very expensive and have high environmental and social impacts (such as noise, or the emissions associated with transporting significant amounts of soil to landfill). In many cases heavy engineering solutions are the only realistic option, but in other cases less impactful ways of dealing with risks may be suitable. For example:

- some sites are suitable for soil-treating techniques such as bioremediation, which use plants or micro-organisms to treat soil. This can take much longer than heavy engineering, but it can also be much less expensive and cause much less environmental impact and disruption;
- in other cases, it is possible to deal with the risks without treating the soil. For example, land use restrictions might be applied to ensure a site is not used for a sensitive activity. Or risk communication may be used, for example to ensure people are aware of a risk and how to avoid it. Or there may be scope to use some sites for environmentally benign uses, such as the growing of biofuels which might also contribute to the remediation processes.

Dealing with our legacy of contaminated land

- 7.19. The contaminated land sector in the UK and elsewhere is already looking at ways to improve sustainability, including how to rely less on “dig and dump” techniques that involve disposing of large amounts of contaminated soil in landfills. The Government recently acted to discourage “dig and dump” by announcing that the current Landfill Tax exemption on the disposal of contaminated soil (which had existed since landfill tax was introduced in 1996) will be phased out by 2012.
- 7.20. Defra will continue to encourage the shift to more sustainable remediation. We will work to ensure that remediation only takes place when necessary; to improve knowledge on the costs and benefits of the variety of remediation techniques, building on existing work; and to encourage the use of “smarter” remediation solutions. Initially, this will be achieved primarily through measures such as the new guidance to Local Authorities, and new research on the risks associated with land contamination and the costs and benefits of remediation techniques. In the longer-term, there is likely to be a need for further research, and potentially changes to wider policy, and we will keep this under review.



Defra Photo Library

Infilling quarry with soil

Summary of initial actions

Objectives	Defra will:
Improve understanding of the impacts of contaminated land and sustainable remediation techniques	Undertake further research into: <ul style="list-style-type: none">• impact of contaminated land on human health and the environment• remediation techniques and their wider impact on the environment
Ensure contaminated sites that pose a significant risk to human health and the environment are identified and steady progress is made towards their remediation	<ul style="list-style-type: none">• Continue to encourage action by Local Authorities for sites where there are no market solutions, prioritising higher risk sites and promoting sustainable solutions where possible (new guidance by late 2009)• Continue to provide funding for Local Authorities through revenue support and capital grants

Chapter 8: Future research and monitoring

Research

- 8.1. Evidence is central to good policy making. Through improving our evidence base we can strengthen our understanding of the pressures on soils and the measures that are required to address degradation.
- 8.2. Defra funds a wide range of research, in partnership with other funders, in particular to investigate the impacts of land application of organic and inorganic materials on soil quality, the mechanisms behind soil degradation, and impacts on water and air quality. Details of our recent and current soil protection research are available on the Defra website.²⁵
- 8.3. Key gaps in our evidence base are highlighted throughout the Strategy. We will work closely with other research budget holders to coordinate the commissioning of research to fill these gaps. We will also work with partners in the Living With Environmental Change²⁶ (LWEC) initiative, a ten year programme which brings together a range of Research Councils and decision making bodies to provide decision makers with the best information to effectively manage and protect vital ecosystem services, to ensure that soil aspects are included in LWEC programmes.
- 8.4. We also need more evidence on the ecosystem services that soils provide for society, the value of these services, assessments of the pressures soils face, how resilient service delivery might be to these pressures and the means to manage continued delivery of these services. Defra is currently supporting, together with Natural Environment Research Council and the Devolved Administrations, a National Ecosystem Assessment (due to report early in 2011) which will seek to address some of these issues for soils as an integral part of terrestrial habitat and ecosystems across the UK. This Assessment will follow the global Millennium Ecosystem Assessment model by synthesising existing evidence on the state of our natural environment and ecosystem services. The Assessment will cover a broad range of ecosystem services, including those provided by soil, and so should assist considerably in collating, analysing, and communicating the evidence in this area.



Field trials

Rothamsted Research

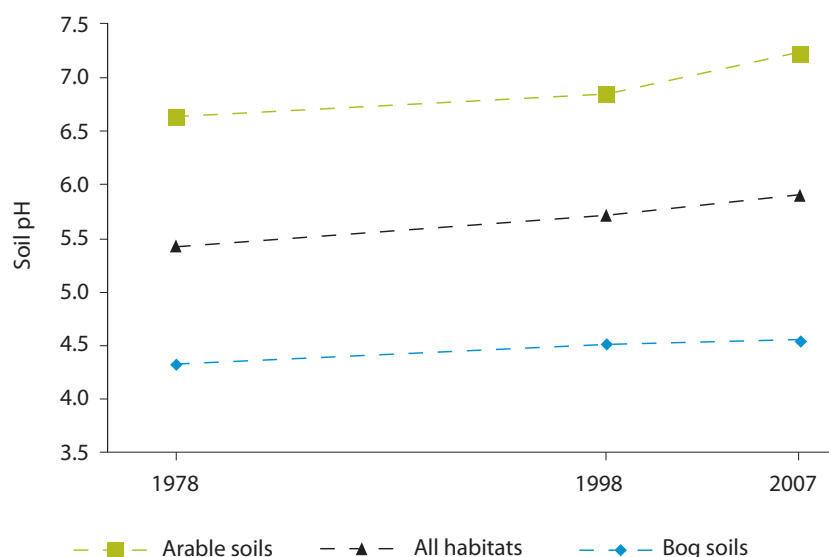
²⁵ <http://www.defra.gov.uk/science/default.htm>

²⁶ <http://www.nerc.ac.uk/research/programmes/lwec/>

Monitoring

- 8.5. Soil monitoring provides vital evidence on the state of and change in our soils. This data is used to underpin policy development and allows us to evaluate their effectiveness. Many soil properties change only very slowly and soil monitoring cycles tend to be 5 to 15 years apart.
- 8.6. Long term monitoring of the state of the natural resources of the UK's countryside has been done through the Countryside Survey since 1978. The initial soils analysis from the Countryside Survey of 2007 was published in November 2008; it demonstrated a continuing trend in decreasing soil acidity and no overall change in soil carbon since 1978 (see paragraph 3.7). The full analysis will be published towards the end of 2009.
- 8.7. The UK Soil Indicators Consortium (a cross-Government working group, led by Defra) was formed in 2003 to develop a set of robust indicators of soil quality and to develop a UK-wide soil monitoring scheme. It has identified and tested a preliminary set of soil quality indicators, and funded a stock-take of existing environmental and soil monitoring and a project to design a new UK Soil Monitoring Network. The latter project concluded that, given the wealth of historical data associated with existing soil monitoring schemes (e.g. the Countryside Survey and the National Soil Inventory), it would be difficult to justify establishing an entirely new scheme from new locations with no pre-existing data. It recommended that priority should be given to exploring the options for gaining the required information from existing monitoring schemes.
- 8.8. Defra will consider options for making further use of existing soil monitoring schemes, before giving consideration to putting in place a new scheme. We will liaise with the Environment Research Funder's Forum²⁷ (ERFF) Environmental Observation Framework to ensure that any new activity to monitor our soils is well co-ordinated with other similar activities.
- 8.9. We are also currently trialling some new biological indicators of soil quality for possible inclusion in future soil monitoring programmes.

Figure 7: Changes in the average pH of soils (0-15cm) from sampling plots in all habitats in Great Britain between 1978 and 2007



Source: Environment Agency

²⁷ <http://www.erff.org.uk>.

Chapter 9: Working together

- 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 an interest in soil policy development or a role in delivering our outcomes.
- 9.2. Defra has been working with a large range of stakeholders over recent years, in particular those represented on the Soil Action Plan Advisory Forum. This included representatives from the farming, environmental and academic/research sectors, as well as a number of key Government Departments and Agencies who acted as delivery bodies for some of the specific elements of the Action Plan. Defra has also worked with other Government Departments and the Devolved Administrations on areas where we share common interests. These partnerships will need to be maintained and built upon in order to deliver this Strategy.

Our priorities for the future

- 9.3. As part of taking forward this Strategy, we will review the membership of the current Soil Action Plan Advisory Forum (which will become the Soils Advisory Forum), and extend it to include all interested stakeholders. We plan to hold annual meetings of the Advisory Forum to provide an update on progress and future plans on soil policy. The Advisory Forum will also assist with monitoring and evaluating the delivery of this Strategy. We will also look to strengthen our relationships with research institutions, the farming sector and industry in delivering the objectives in this strategy.
- 9.4. We will continue to work closely with our delivery partners (including Natural England, the Environment Agency, the Forestry Commission England, and the Rural Payments Agency) as well as with other Government departments with an interest in soils policy most notably, Communities and Local Government (CLG), the Department for Business, Innovation and Skills (BIS) and the Department for Energy and Climate Change (DECC).
- 9.5. Soil is a devolved policy area and whilst this Strategy is for England only, there are many similarities in the issues facing soils throughout the UK. Defra will continue to work with the Devolved Administrations on many of the priority work areas to ensure that our approach is consistent. Such engagement at the UK level will also help to promote more effective information exchange, particularly in relation to soil research.

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