Countryside Survey: England Results from 2007
Foreword by Huw Irranca-Davies MP, Minister for the Natural and Marine Environment, Wildlife and Rural Affairs, Department for Environment, Food and Rural Affairs

Our rich and varied countryside is at the heart of our prosperity. It has sustained us through our long history of settlement and development. Although it has changed over time, it continues to provide us with fertile soils for agriculture, woodlands, flowing waters and a remarkable diversity of wildlife. The interactions between the wildlife, soils and climate have enabled complex ecosystems to evolve, which provide a range of goods and services, such as timber production and carbon storage. The countryside enriches our lives, financially, culturally and spiritually.

To manage the natural resources of our island for the future, it is essential that we understand how the countryside changes, and how our activities can affect it. In addition to natural processes, people have been involved in the shaping of our landscapes, but we also know that climate change, pollution, agricultural practices and demand for land can affect the countryside.

The Countryside Survey is a world-leading method of investigating change across the countryside. It tells us about the changes in our vegetation, soils, freshwaters, habitats and landscape features and enables us to look at interactions between these and to determine possible causes of change. Importantly, though, it provides the scientific evidence we need to inform our policy making decisions.

The Countryside Survey has grown in size and complexity over time, and this year is the first opportunity we have had to produce separate reports for each of the countries in the UK. The England Report provides us with an opportunity to examine changes in the English countryside and helps to give us a clearer focus on the issues affecting our part of the UK.

Many people have been involved in delivering the Countryside Survey, from scientists to land owners who kindly gave permission for access to their land. Its success has depended upon the effective partnership between NERC and the other government partners representing all the devolved administrations and relevant agencies across the UK.

Huw Irranca-Davies
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This report is divided into nine chapters. Chapter 1 is the introduction and methodology, Chapter 2 an overview or national picture, and Chapters 3-9, each cover particular Broad Habitats (and a few Priority Habitats), as shown in the contents list. Chapters 3-9 present summaries, figures and tables of the results of the survey followed by discussion and main conclusions.

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Countryside Survey:
England Results from 2007
The Countryside Survey of 2007 is funded and managed by a partnership of government funded bodies led by the Natural Environment Research Council (NERC) and the Department for Environment, Food and Rural Affairs (Defra). Other partners include: Natural England, Welsh Assembly Government, Scottish Government, Northern Ireland Environment Agency, Forestry Commission, Countryside Council for Wales and Scottish Natural Heritage.

The completion of the survey has only been made possible by the support and advice of many dedicated individuals from these and other organisations who provided their time and valuable advice to the project board, the project steering group, and the project advisory groups.

The project Partners would like to thank all the landowners, farmers, and other land managers who gave permission for the field surveyors to collect data and samples from their land. Without such cooperation, scientific field studies like Countryside Survey would not be possible.

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1. Introduction and Methodology

Summary

This Chapter provides an introduction to the Countryside Survey report for England and describes the report structure and content. Where appropriate, references are made to the UK report released in 2008 in which the rationale and methods used to collect the data for Countryside Survey in 2007 and in the preceding Surveys are described in more detail.

The results of the field survey focus on habitats, vegetation, soils (0-15 cm) and freshwater. The field survey covered a total of 289 1km x 1km sample squares across three Environmental Zones in England. These 1km sample squares were representative of the variations in the climate and geology present.

The data collected enables estimation of:

• the extent and change in area of habitats;
• the extent and condition of landscape features such as hedges, walls and trees;
• the changing condition of vegetation in habitats;
• the pH, carbon concentration and bulk density of soils (0-15cm); and
• the changing condition of freshwaters and ponds.

Countryside Survey (CS) is a unique study of the natural resources of the countryside. The survey has been carried out at intervals since 1978 with the latest in 2007. The countryside is sampled and studied using rigorous scientific methods, so that the results can be compared with the findings of the previous surveys in 1998, 1990, 1984 and 1978 to measure and analyse change. In this way the gradual and subtle changes that occur can be studied over a 30-year period. Evidence produced is used to review and develop policies that influence the management of our countryside e.g. providing information on progress against the UK Biodiversity Action Plan for Broad and Priority Habitats. The main objectives of Countryside Survey are given in Box 1. The findings will be used for a range of scientific (Box 2) and policy (Box 3) applications.

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1 Full details of the methodology are provided in the “UK Results from 2007” and the accompanying Technical Reports available at http://www.countrysidesurvey.org.uk


Box 1: The overarching objectives of Countryside Survey in 2007 were:

- To record and report on the amount and condition of widespread habitats, landscape features, vegetation, land cover, soils and freshwaters.
- To assess changes in the countryside and improve our understanding of the causes and processes of change, by comparison with data from earlier surveys.
- To collect, store and analyse data in ways that optimise the integration of Countryside Survey data through time and make it compatible with other data sources.
- To provide access to data and interpreted results that underpin a range of policy and science needs for major environmental zones and landscape types in the UK, Great Britain, England, Scotland, Wales and Northern Ireland.
- To contribute to the development of an integrated assessment of the drivers and pressures of change and better understand their effects on the UK countryside and their implications for ecosystem goods and services.

Box 2: The scientific challenge

To manage land more sustainably we need to know what is there, monitor how it is changing, uncover the causes of change, predict the consequences of future change and assess options for adaptation. Stakeholders increasingly require this complex research challenge be met, whether to develop a more sustainable energy policy, to ensure that soil resources are managed, or that environmental conflicts are resolved. Countryside Survey provides the scientific evidence needed by government decision-making to help deliver a healthy natural environment, ecosystem services and energy in a manner consistent with the goal of achieving sustainable development.

The scientific challenge is to develop a fully integrated ecosystem assessment of UK which will link the key pressures of change to changes in state of the countryside and the effect of these on ecosystem services. Countryside Survey data will make a significant contribution towards this aim and many other areas of science including:

- Attribution of change in stock of key attributes to a range of pressures and drivers, particularly land management, climate and air pollution.
- Analysis of stock and change of indicators within regions, selection between conflicting hypotheses of change and development of process models that can be tested against data from future surveys.
- Assessment of stream biological condition in relation to catchment soil characteristics.
- Increased understanding of the mechanisms and inter-dependencies between soils, vegetation and water quality parameters, underpinning modelling requirements for linking biodiversity and biogeochemical cycling (e.g. in soil carbon models).
- Application of process models of pressure-state relationships to reveal likely trends, sensitivities and time lags of ecosystem indicators.
- Development of high-level indicators of ecosystem services.
- Spatial analysis of the resilience of vegetation and ecosystem attributes to specific pressures, identifying the situations in which ecosystem change is most likely and ecosystem services at most risk.
- Linking of data and models to provide pressure-state-impact assessments of past changes and provide basis for testing of future policy scenarios on ecosystems services in the countryside.
There are two main elements to Countryside Survey: field surveys (reported here) which focus on habitats, vegetation, soils (0-15 cm) and freshwater; and the Land Cover Map which uses data from satellites to form a digital map of the different types of land cover across the UK and will be published later in 2009. The field survey provides estimates of the extent of the different Broad Habitats (see Box 4) and in 2007, for the first time, some Priority Habitats were also reported in the UK Results from 2007 report. The results of the field survey describe the character and condition of the different vegetation types associated with these Broad and Priority Habitats, including both land and freshwater habitats.

Box 4: The Broad Habitat Classification

“It is vital to be able to identify and record species and ecological communities of interest that are under threat so that they can be related to a legal framework to ensure their protection. Species and habitat classification provides a language through which data can be communicated at a national and international level.

The Broad Habitat classification was developed as a part of the UK Biodiversity Action Plan. The list of Broad Habitats that was published in the UK Steering Group Report in 1995 has been subject to a recent review to ensure that the whole of the land surface of the UK and the surrounding sea, to the edge of the continental shelf, is covered. This has resulted in a revised list of 27 Broad Habitats but not all are covered by Countryside Survey. The Broad Habitats are the framework through which the Government is committed to meet its obligations for monitoring in the wider countryside...”

(The Joint Nature Conservation Committee – www.jncc.gov.uk/page-1425)

The terrestrial Broad Habitats covered by Countryside Survey are:

- Broadleaved, Mixed and Yew Woodland
- Coniferous Woodland • Boundary and Linear Features
- Arable and Horticulture • Improved Grassland
- Neutral Grassland • Calcareous Grassland
- Acid Grassland • Bracken • Dwarf Shrub Heath
- Fen, Marsh and Swamp • Bog • Inland Rock • Montane
- Standing Open Waters and Canals • Rivers and Streams
- Littoral Sediment • Littoral Rock
- Supra-littoral Sediment • Supra-littoral Rock
- Built-up and Gardens

Box 3: Policy applications of Countryside Survey

The UK Sustainable Development Strategy ‘Securing the Future’ (2005) committed the Government to undertake a new Countryside Survey in 2007 to assess the status of natural resources in the UK countryside. Countryside Survey has many potential policy applications:

- **Biodiversity**: assessment of status and trends in Broad and Priority Habitats, measuring progress towards the 2010 target of halting biodiversity loss.
- **Natural environment**: measurement and improved understanding of ecosystem goods and services.
- **Sustainable agriculture and agri-environment schemes**: understanding effects of agricultural policy on the natural environment, including assessment of farmland habitats such as grasslands, hedges and cereal field margins.
- **Water resources**: context and baseline assessment for the EU Water Framework Directive, especially for headwater streams and ponds.
- **Soil protection**: measurement of long-term trends in soil quality, including soil carbon.
- **Sustainable forestry**: information on isolated trees and plant diversity within woodlands, to supplement the National Inventory of Woodlands and Trees.
- **Urban development**: estimates of areas of habitat affected by urban development.
- **Air quality**: assessment of impacts of air pollution on terrestrial habitats, soils and headwater streams.
- **Climate change**: provide information to help estimate carbon emissions from land cover change and soils, and to detect impacts of climate change in the countryside.
- **Uplands**: assessment of changes in uplands habitats (such as bracken) and landscape features (such as hedgerows and walls), and changes in land management (such as grazing) and increase in Built Up and Gardens Broad Habitat.
- **Pesticides**: assessment of plant species richness in cropped areas, and in agricultural landscapes in general.
- **Landscape**: assessment of changes in landscape features, especially in particular regions of England where particular habitats or features may contribute to landscape quality.

The terrestrial Broad Habitats covered by Countryside Survey are:
The UK results of the latest 2007 survey were published in November 2008 and the summary data made accessible via the Countryside Survey website. CS has grown in scale and complexity over the years, and for the first time, the 2007 survey has enabled reporting at individual country level. This report presents the Official Statistics for England and compares differences across three sub-divisions of the country known as Environmental Zones (EZs). The results are presented in chapters structured around the same Broad Habitat groupings used for the UK report. Each chapter is concluded with a discussion which begins to explore the relevance of these results for England with an emphasis on their policy context. CEH is responsible for the scientific evidence presented while Defra, Natural England and the Forestry Commission have contributed to the contextual discussions. Equivalent reports have been produced in parallel for Scotland and Wales.

Details of the field survey methods used to collect the data for CS in 2007 and preceding Surveys are not reproduced in full in this report, since they are presented in Chapter 1 of the UK Results for 2007 report (available at: http://www.countrysidesurvey.org.uk). A short overview of the sampling strategy is provided here with some expansion to cover certain aspects of the methodology that are specific to England and to explain the EZ sub-divisions of the country.

**Methodology**

Prior to 1998, the CS sampling strategy was designed to provide estimates for GB level reporting, not for reporting at the individual country level. In 2007, the field survey involved an in-depth study of a sample of nearly 600 1km x 1km squares across Great Britain; 289 of these were in England.

Individual survey squares in England were randomly selected so that they represent variations in climate and geology across the country. Widespread terrestrial habitat types are sufficiently well represented to enable robust and reliable statistical analyses. The locations of the survey squares are not disclosed to avoid any deliberate influences that could affect them or the features within them. In this way, the survey squares will remain representative of changes in the wider countryside and will continue to provide a reliable comparison for future surveys.

Areas of habitat were mapped within each square and more detailed samples were made of vegetation in a series of plots. The plots varied in size depending on the feature being sampled, but in all plots the species of plant present and the percentage of the area they covered were recorded. Soil (0-15cm) samples were also collected from five plots in each square. A stream and a pond were also sampled in those squares where they were present. The data collected enables estimates to be made of:

- the extent and change in area of habitats;
- the extent and condition of landscape features such as hedges, walls and trees;
- the changing condition of vegetation within habitats;
- the pH, carbon concentration and bulk density of soils (0-15cm); and
- the changing condition of freshwaters and ponds.

Further analysis of soils is ongoing to enable estimation of nutrient status, contaminant levels, soil biotic diversity and soil function and will be reported in late 2009.\(^4\)

\(^4\) Details of the soil protocols and methodology are provided in the CS Soils Manual available from http://www.countrysidesurvey.org.uk
The recording framework for Broad Habitats within CS makes it possible to report on both the area and the change in area for Broad and a few Priority Habitats, using the data from the 1990, 1998 and 2007 Surveys. A modified coding system for habitat mapping was introduced in 1998 to enable reporting on Broad and Priority Habitats. The modified system has backwards compatibility to 1990 for most Broad Habitats. Similarly, the methods of recording linear features have been refined over time. Where there has been consistency of recording over time, the length of linear landscape features and the numbers of point features including trees and ponds (and changes in those lengths and numbers) can be reported.

Vegetation, freshwaters and other landscape features were studied in detail within each square (using various types of sampling ‘plots’) and compared with findings from previous Countryside Surveys, enabling identification of change in the countryside. The results presented here focus on changes in the nine years since the last Countryside Survey in 1998 and, where possible and relevant, they are set within the longer timescale from the first survey carried out in 1978. Changes are only described and discussed where they are statistically significant (where they could only occur by chance in less than 5% of cases).

The condition of the vegetation included in each mapped area of Broad Habitats were reported for the 1990, 1998 and 2007 Countryside Surveys. The position of each vegetation plot is known and so the species data recorded in each plot can be referenced to the Broad Habitat in which it was sited. Assessments of the condition of linear features are confined largely to more recent Countryside Surveys in particular 1998 and 2007. This report also includes details of individual plant species which are occurring with the most increasing or decreasing frequency of occurrence in plots across England.

Priority Habitats are habitats that have been identified as a priority for conservation in the UK Biodiversity Action Plan (BAP)\(^3\), and are assessed on a regular basis. As Countryside Survey represents an unbiased sample of the UK countryside and these Priority Habitats are generally uncommon and/or localised, they are generally not well represented within the CS e.g. Reeds. The results for a limited number of Priority Habitats are presented in this report. They represent national estimates based on a sample and should be used in conjunction with other estimates published by the UK BAP. Some CS estimates are very similar to UK BAP while others differ markedly. Neither can be considered definitive at present and will be investigated further. The CS estimate for Hedgerows, Ponds and the condition of Arable Field Margins represent the only national figures for these Priority Habitats.

Sub-dividing England, Scotland and Wales into Environmental Zones (EZs) enables changes across the countries and within habitat types to be compared between geographically different regions. The nine EZs used in the 2007 Survey across the UK are summarised in Table 1.2 and the distribution of those within England relative to survey square locations is presented in Fig. 1.1. It is difficult to find succinct names which adequately describe them but they cover the range of environmental conditions found in the UK from the lowlands of the south and east, through to the uplands and mountains of the north and west. The EZs are based on combinations of the underlying sampling units, or land classes, used to identify survey squares for the stratified random sampling of the countryside.

### Table 1.2: The Environmental Zones used in Countryside Survey.

<table>
<thead>
<tr>
<th>Environmental Zones</th>
<th>EZ codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easterly Lowlands, England (EL)</td>
<td>EZ1</td>
</tr>
<tr>
<td>Westerly Lowlands, England (WL)</td>
<td>EZ2</td>
</tr>
<tr>
<td>Uplands, England (UP)</td>
<td>EZ3</td>
</tr>
<tr>
<td>Lowlands, Scotland</td>
<td>EZ4</td>
</tr>
<tr>
<td>Intermediate Uplands and Islands, Scotland</td>
<td>EZ5</td>
</tr>
<tr>
<td>True Uplands, Scotland</td>
<td>EZ6</td>
</tr>
<tr>
<td>Northern Ireland (reported separately)</td>
<td>EZ7</td>
</tr>
<tr>
<td>Lowlands, Wales</td>
<td>EZ8</td>
</tr>
<tr>
<td>Uplands, Wales</td>
<td>EZ9</td>
</tr>
</tbody>
</table>

There are three EZs in England: Easterly Lowlands, Westerly Lowlands, and Uplands (Fig. 1.1).

### Figure 1.1: The distribution of the three Environmental Zones within England relative to survey square locations (EL - Easterly Lowlands, WL - Westerly Lowlands, UP - English Uplands).

\(^3\) http://www.ukbap.org.uk
Interpreting Results

Landuse versus landcover

Countryside Survey involves visits to 1km squares to record habitats based on the vegetation present at that time: it is therefore a measure of landcover. This is subtly different to measures of land-use, which are based on what the land is being used for.

The difference between these two definitions can lead to quite different estimates of the national area of a particular habitat.

Two obvious examples are woodland (both broadleaved and coniferous) and arable land. In Countryside Survey, a parcel of land must have at least 25% canopy cover of broadleaved or coniferous trees to be classified as woodland, but in land-use surveys such as those by the Forestry Commission, land that has been cleared of trees and awaiting replanting will remain classified as woodland.

In Countryside Survey, land in long-term fallow, and formerly set-aside, is classified as grassland whereas in some land-use surveys it may remain classed as arable land.

Statistical change

The statistical tests used to analyse the results can lead to some incidences where small changes are statistically significant and where large changes are not. Small changes can be significant when the sample size is very large, and conversely, large changes may not be statistically significant when the sample size is small.

There can be significant changes in some of the characteristics of vegetation tables even if the values remain the same between time periods. For example, it is possible for there to be a significant change in the number of species in vegetation plots between 1998 and 2007 even if both values read as 10.6. This will occur if there are a large number of plots. It should also be borne in mind that 10.6 encompasses the range from 10.551 to 10.649 when these figures are converted to 1 decimal place.

Condition Characteristics: Stress Tolerator, Competitors and Ruderal Scores.

The condition characteristics of vegetation is assessed using the three components of Grime’s triangle:\[5\]: Competitor, Stress Tolerator and Ruderal, and plant species are assigned Scores related to these characteristics. Taken together, this can indicate ways in which vegetation is changing. An example might be where a dry open area becomes flooded and invaded by species with a high Competitor Score that can tolerate flooding and a high Stress Tolerator Score e.g. Meadowsweet (*Filipendula ulmaria*). If a site became affected by a mineral pollutant it might be that species with a high Competitor Score would die leaving gaps where only ruderal species and species able to tolerate the stress caused by the minerals could survive.

These are extreme examples, but in the wider countryside, the Countryside Survey results tend to show more subtle shifts e.g. from species that prefer open spaces (high Ruderal Score) towards the other two types which could indicate less management, higher nutrients and less drought amongst other factors. Different factors may also be interacting in a many different ways. For example, grazing by livestock can affect the proportions of the three types of characteristic Scores in very different ways. Very heavy grazing can increase the proportion of ruderal species, low levels of grazing will allow species with high Competitor Scores to dominate, while medium to heavy grazing should favour some species with a high Stress Tolerator Score.

Further information

More details of the methodology, analyses and results from Countryside Survey can be found in other companion reports and data resources available for the Countryside Survey website [www.countrysidesurvey.org.uk] including:

**Reports:**
- UK Headline Messages – published November 2008
- UK Results from 2007 – published November 2008
- Scotland Results from 2007 – published June 2009
- Wales Results from 2007 – published July 2009
- England Results from 2007 – this report, published September 2009
- Northern Ireland Countryside Survey results – published April 2009
- Ponds – late 2009
- Headwater Streams – late 2009
- Soils – late 2009
- Integrated Assessment – 2010

**Data resources:**
- Web access to summary data - a systematic summary of the results used to inform the UK and country level reports – launched in November 2008 and updated in January 2009
- Web access to data from individual survey squares used to generate the results presented in Countryside Survey reports from the 2007 survey – licensed access available from June 2009
- The UK Land Cover Map for 2007 (to be released in 2010)

The data generated by Countryside Survey will continue to be investigated in conjunction with other information such as climate, pollution and agricultural statistics. The data is being used in the UK National Ecosystem Assessment. Phase 1 will report in February 2010 and Phase 2 in February 2011 [see http://www.unep-wcmc.org/eap/ukNationalEA.aspx].

It is anticipated that future analysis of Countryside Survey data will lead to scientific journal articles over the coming years. These investigations will improve understanding about the possible causes of the changes detected in the countryside and, for example, provide an opportunity to explore the results for Priority Habitats in more detail.

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The Countryside Survey partnership has endeavoured to ensure that the results presented in this report are quality assured and accurate. Data has been collected to estimate the stock, change, extent and/or quality of the reported parameters. However, the complex nature of the experimental design means that results can not necessarily be extrapolated and/or interpolated beyond their intended use without reference to the original data.