The Royal Commission
on Environmental Pollution

DEMOGRAPHIC CHANGE AND THE ENVIRONMENT

The Royal Commission on Environmental Pollution

CHAIRMAN: SIR JOHN LAWTON CBE, FRS

Twenty-ninth Report

Demographic Change and the Environment

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The cover image was kindly provided by Benjamin Hennig, Sasi Research Group, University of Sheffield. The image shows the relative proportion of the population living across the UK. Densely populated areas have more space, whereas sparsely populated areas are diminished in this map. Only three rivers are shown, these provide visual markers of UK geography.

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Royal Commission on Environmental Pollution

Twenty-ninth Report

To the Queen's Most Excellent Majesty

May it please Your Majesty

We, the undersigned Commissioners, having been appointed 'to advise on matters, both national and international, concerning the pollution of the environment; on the adequacy of research in this field; and the future possibilities of danger to the environment';

And to enquire into any such matters referred to us by one of Your Majesty's Secretaries of State or by one of Your Majesty's Ministers, or any other such matters on which we ourselves shall deem it expedient to advise:

Humbly submit to Your Majesty the following report.

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Chapter 1

Introduction and overview

1.1 In 2009, the Royal Commission on Environmental Pollution announced that it would investigate the environmental implications of demographic change, looking at the next forty years to 2050.[a] The Commission chose to study this topic because although there may be a growing understanding of the ways in which the UK population is changing – and much thought is already being given to the social and economic implications of these changes – it seemed that little attention had so far been paid to their environmental consequences. The Commission decided that this was an area in which it could make a useful and timely contribution.

1.2 Forty years ago, the potential impact of a growing population was exercising the minds of the politicians of the day, and in 1971 the House of Commons Select Committee on Science and Technology called on the Government to act "to prevent the consequences of population growth becoming intolerable for the every day conditions of life".[1] The Government responded by setting up a panel of experts and officials, the Population Panel, to review the issue: this group carried out a comprehensive analysis of the implications of the population of Great Britain (GB) growing from 54 million (the level reached in 1971) to "around 64 million at some time during the first decade of the next century".[b] In the event, the GB population was estimated to have reached approximately 60 million in 2009.[2]

1.3 The Report of the Population Panel was published in March 1973.[3] It was not primarily about the environmental consequences of demographic change, but it did cover a number of issues that have emerged as themes during the course of our own study. The Panel acknowledged that many problems – including those affecting the environment – can be made worse if there are more people. However, it also drew a careful distinction between the impact that an increasing population could have on resource use and pollution, and the effects of rising standards of living, which it considered likely to be much more important.

1.4 Box 1A at the end of this chapter contains a series of quotations from sections of the Report. We have reproduced these, not because the Commission necessarily agrees with them, but because they succinctly capture many of the ideas and controversies that surrounded this subject at the time, several of which remain controversial today.

1.5 Nearly 40 years on, in 2010, much has changed in our society, economy and environment. Progress has been made in dealing with some of the environmental problems of the past, though new challenges remain to be tackled. But the prospect of a growing population still provokes a good deal of comment and, in some quarters, concern. Over the period of our study, articles or special features have appeared in numerous journals and newspapers, and statistical bulletins have regularly given rise to popular media reports and lively correspondence.

a We announced our study in March 2009. After considering preliminary submissions about its scope and content, we decided to look broadly at the period starting roughly 40 years ago (i.e. 1971, the baseline for the 1973 Population Panel) going forward to 2050, 40 years ahead, and invited evidence to cover that period in September 2009. In practice, 2033 is currently used as the end-point for a number of projections.

b The Report of the Population Panel quoted population figures for Great Britain; in most places in our report we have quoted population figures for the United Kingdom.

1.6 The basic demographic facts are that, since the Population Panel reported in 1973, the population of the UK has grown steadily – from 55.9 million in 1971 to 61.8 million in 2009.[4] This trend is likely to continue: the Office for National Statistics (ONS) has published projections suggesting that the population could be 71.6 million in 2033.[5] Within the overall figure, there are a number of important trends – in particular, a significant increase in the number of people over 85 years old, and an even bigger increase in the number of households, particularly one-person households.

1.7 Perhaps even more crucially, demographic pressures vary in different parts of the UK. Some areas are expected to grow significantly faster than others, whereas in some parts of the UK the population has been decreasing and may continue to decline. In the course of our study, the Commission made several visits and received a large amount of evidence which illustrated just how significant these variations are.[c] There are differences in fertility rates, average lifespan and inward and outward migration between the countries of the UK and their regions, so the demographic profiles of each country and region are different and will evolve in a variety of ways. The Commission also found significant variations at a more local scale, a number of which are described in detail in later chapters.

Scope of the current study

1.8 In the initial phases of this study, the Commission was struck by the relative lack of research into, or detailed analysis of, the environmental impacts of demographic change in the UK. There had been much coverage of population growth and ageing in the media, and it was clear that some Government departments (such as the Department for Work and Pensions, and the Department of Health) had been actively considering how to cope with the changes ahead, but the main focus had been on economic, health and social issues. It was clear to us that the same demographic trends could present environmental challenges. We also accepted the premise that environmental impacts are not always negative – there can sometimes be positive impacts.

1.9 The Commission recognises that demographic change is but one of many factors which will influence society and will have environmental impacts over the next twenty years. The need to mitigate and adapt to climate change is one key driver,[6] but there will be others such as technological development, which can either increase or moderate the environmental impact of where and how people live. Economic circumstances and changing levels of affluence and consumption may be more important influences on environmental impact than simply the number of people. We consider these influences in later chapters. While this is not a report about sustainable consumption and production, this is a vital and complicated area on which much work has already been, and continues to be, carried out by others.

1.10 We recognised that we would need to put some limits on what we could reasonably consider, and our aim in taking forward this study was to explore a number of specific trends highlighted during the scoping phase of our work.[d] The specific trends we identified as most likely to have a significant impact on the UK environment were:

- projected increases in the total population;
- the changing age structure of the population;

c A record of our discussions during each of these visits and all the written evidence (save that which contributors asked should not be published) is available on our website www.rcep.org.uk. When the website closes in late 2011, the information will be available via The National Archives.

d Details of the conduct of the study can be found in Appendix A.

- changes in household size and composition;
- the distribution of population between urban and rural areas; and
- the regional distribution of population and the regional variation in demographic change.

1.11 Of course, the UK is not the only country facing significant demographic change. Globally, population numbers are rising, although the rate of growth is decelerating; according to figures published by the United Nations in March 2009, the world population is projected to exceed nine billion by 2050, with most of the increase occurring in developing nations.[7] Many other developed countries are likely to experience an even more pronounced change in the age structure of their populations than we face in the UK. Developing countries currently still have a relatively young age profile, but are also expected to undergo the transition to an older population structure, and to do so more suddenly than developed nations.[8]

1.12 However, for practical reasons, we have restricted our study to the implications of demographic change in the UK and have not addressed the wider question of the environmental implications of global demographic change. We recognise that there are links: demographic change in the UK is in part driven by immigration and emigration, and the 'environmental footprint' of the population of the UK extends well beyond our own borders. However, to examine such aspects would have extended considerably the scope and timing of our study and would have involved consideration of a different range of evidence. Moreover, broader facets of the topic are currently being examined in separate studies being undertaken by the Royal Society[9] and in a Government Office for Science Foresight project.[10]

1.13 In the light of the responses we received to our initial scoping study, we also decided to concentrate our request for detailed evidence on a small number of environmental issues such as demand for water, water quality, waste generation and management, air quality, the impacts on land and biodiversity and, to some extent, energy use and associated greenhouse gas emissions. We decided not to examine food sustainability and security, since the Government Office for Science Foresight team was examining this issue and is due to publish its report in January 2011.[11]

Overview

1.14 Current trends suggest we can expect a growing population in the UK – fuelled by increasing life expectancy and net inward migration – and an increasing number of households, more of them occupied by only one person. But these trends do not apply uniformly across the UK and we were struck by the intense graininess of the situation at all levels (Chapter 2). Where people are, and how they live, have major environmental impacts. More importantly, policies to influence behaviour and consumption may be more effective than any attempt to constrain or even reduce population size.

1.15 We found that the sheer number of people is not likely to be the most significant influence on environmental quality in the UK over the next 40 years: the impact of any population on the environment is mediated by the way people live – their consumption patterns, the energy and water they use, and the waste they generate. If we are serious about reducing the impact of population on the environment, these issues need to be given at least as much attention as overall numbers (Chapter 3). There is a relationship between the size of the population and certain basic environmental services, such as water supply and quality, energy use and waste generation. But we found that this relationship was not as clear as might be expected. We were also surprised that, to the extent that they were aware of the challenges ahead, public bodies and service providers had

to cope with very varied circumstances and were preparing for them in a range of different ways. As mentioned, the way population is distributed is crucial to any understanding of environmental impact – where people live, work and travel affects the environment in the broadest sense (Chapter 4) and this suggests that there needs to be a thorough evaluation of the role of the planning system to ensure that proper account is taken of the impact of growth or depopulation (Chapter 5). In Chapter 6, we set out our views on what should be done.[e]

BOX 1A QUOTATIONS FROM REPORT OF THE POPULATION PANEL (1973) GATHERED INTO BROAD TOPIC AREAS

The numbers refer to the numbered paragraphs in the main body of the original report.

(6). Experience shows how wrong population projections can be. But however imperfect the projections, policy needs to be based on some view of the future.

(7). Concern has been expressed about the present size of Britain's population and its prospective increase. This concern stems from disquiet about … [among other issues] problems of pollution, congestion and noise; health, social tensions, individual stress and alienation; land use; [and] the implications of increased demands on world resources …

(9). Such projections as we have been able to make suggest that the difference to be expected from different rates of population change would be very small when compared with the substantial increase in both private consumption and public services to be expected from rising productivity over the next 40 years.

(13). It is often claimed that the problems associated with [a highly urbanised] society would be less acute if the population were smaller. Pollution, urban congestion and the general increase in noise levels are obvious examples. (14). In fact a very large part of environmental pollution and congestion is due to levels and rates of increase in standards of living and industrial production. (15). There is little evidence to suggest that in Britain any of these problems would be significantly less serious if population growth were somewhat lower; or that measures to control the rate of population growth would make a significant contribution to the solution of such problems during the next two or three decades.

(333). Over the last six years population in this country has increased by less than 3% but the number of cars by over 30%. Restriction on private cars will need to be imposed in the future regardless of the growth of population.

(334). Noise, particularly from road and air traffic, is felt to be a serious and growing nuisance. It is not, however, mainly a population problem. Rising standards of living have contributed much more than rising population to the increase in noise levels … [But] [t]o some extent … a larger population will tend to produce a noisier environment…

(17). Land use and population distribution pose difficult problems for policy. (18). It is the distribution of population, rather than its overall size, that is important in this context. (330). It is wrong to talk of a general land problem. The problem is what will happen in particular areas … Population growth plays a relatively minor part in creating these local pressures. Increasing affluence and internal migration are the major factors involved. A slower rate of population growth will enable the problems of organisation to be resolved more easily, though it must not of itself be regarded as likely to solve the problems.

e This study was completed in autumn 2010, and takes account of information and data which were available up to the end of September in that year.

(335). The pollution of land, water and air in Britain creates problems which have been widely discussed … Pollution is largely of our own making … It is due to a history of technical change in industry and agriculture, which fails to give weight to environmental consequences; to growing affluence, which has increased the amount of material per head discarded into our limited environment; and to the growing number of people, especially as they are concentrated in certain areas. In the absence of anti-pollution action a growing population would make things worse. (338). A considerably greater contribution [than the rate of population growth] to the threat of pollution and to the cost per head of preventing it will be made by the rising standard of living.

(25). [W]hatever importance may be attached to the desirability of cutting down our population, we are all agreed that there is no conceivable action which could be taken which would reduce Britain's population within the next 40 years to a level consistent with self-sufficiency. (28). In the present context, the objective should be not to retreat towards an unattainable state of self-sufficiency, but to do all we can to foster sustainable patterns of world trade and development.

(381). The concept of 'optimum' population was originally conceived in economic terms: i.e. that population which would produce maximum income per head, or per household, from given economic resources. Other definitions of 'optimum' relate to subjective assessments of 'optimum' density or to criteria such as 'national self sufficiency'. (382). Britain has not been self sufficient … for centuries, so that any attempt to calculate the size of population which would be consistent with self-sufficiency is difficult, if not impossible.

(33). [W]hile we do not know the optimum size of Britain's population nor do we see how on the basis of present knowledge any such optimum might be calculated, our analysis nevertheless leads us to the conclusion that Britain would be better in future with a stationary rather than an increasing population. (34) [A] large number of policy problems would be easier to tackle if the rate of population growth were slower rather than faster. We have found no overwhelming arguments in favour of continuing population growth.

(375). Given the time that any measures to affect population growth might take to act, and the built-in momentum due to the age structure of the population, any slowing down of population growth would have to start some 60 years in advance of the time of reaching a stationary population.

Chapter 2

Setting the scene – Demographic trends and projections

2.1 The population of the UK has grown steadily in recent years and this trend is projected to continue. Figures published by the Office for National Statistics (ONS) in June 2010 show that the resident population of the UK was 61.8 million in mid-2009, an increase of 394,000 (or 0.6%) on the previous year.[1] In the eight years from 2001, the population increased by an average of 0.6% per year, compared with 0.3% per year between 1991 and 2001, and 0.2% per year between 1981 and 1991.[2] The ONS projections of future population suggest an increase of more than 4 million people in the period to 2018; the figures also projected an increase from 61.4 million people in 2008 to 71.6 million in 2033.[a]

2.2 However, within those overall figures, other important themes emerged at a very early stage of this study, including:

- the age structure of the population – the ONS projections highlighted a significant increase in the number of people over 65 years of age, with a particular increase in the proportion of people over 85 years old, and a notable reduction in the old age support ratio;[3,b]
- an increase in the number of households and in particular the number of one-person households – the household projections for England published by the Department for Communities and Local Government (CLG) in March 2009 projected a rise in the number of households from 21.5 million in 2006 to 27.8 million in 2031;[4] and
- the distribution of the population around the country – with particular areas projected to grow disproportionately compared to others over the next few decades, but with sparse, and even declining, populations in other places, particularly in some remote areas. The largest increases are likely to be in regions that are already densely populated, such as the South East of England.[c]

a At the time of writing, the most recent population estimates were those for mid-2009, published by ONS on 24 June 2010. Future projections are calculated once every two years and the most recent figures are those published in October 2009 and based on the mid-2008 estimates. We have therefore used mid-2009 as the base year in some places, and mid-2008 in others, according to context.

b i.e. the number of people of working age for each person of state pension age.

c Where referred to in this form, the 'South East' is equivalent to the area covered by the Government Office for the South East of England (GOSE). This area extends from Kent in the east through to Sussex and Hampshire and the Isle of Wight in the south, and Oxfordshire and Buckinghamshire in the north of the region, as shown in the map at http://www.gos.gov.uk/common/docs/239408/442543. References to 'London' refer to 'Greater London', i.e. the area administered by the Greater London Authority, and incorporating the City of London and the 32 London Boroughs. The 'wider (or 'greater') south-east' refers to Greater London, the South East Region and the East of England Region.

Components of demographic change in the United Kingdom

Natural change and migration

2.3 Changes in population size are a consequence of two distinct sets of factors – the relationship between the birth and death rates of the currently resident population (sometimes called 'natural change') and the balance between inward and outward international migration. Population projections are calculated by making assumptions about three measures: the number of births (related to the fertility rate), the number of deaths (related to life expectancy) and net migration (the difference between migration into and out of the country). Predicting future population numbers is, therefore, very challenging – all population projections require assumptions to be made and are subject to uncertainties, and the further into the future they go the more uncertain the numbers become.

2.4 The birth rate in the UK has risen in recent years: in mid-2008, natural change (the difference between births and deaths) had, for the first time in nearly a decade,[d] overtaken net migration as the main contributor to population growth (Figure 2-I).[e] However, even at the 2008 level of 1.96 children per woman, the total fertility rate was still below the long-term replacement rate of 2.1. So, if fertility levels were to continue to remain below the replacement rate (and other factors such as migration and life expectancy remain the same), the UK population would gradually decline over time.

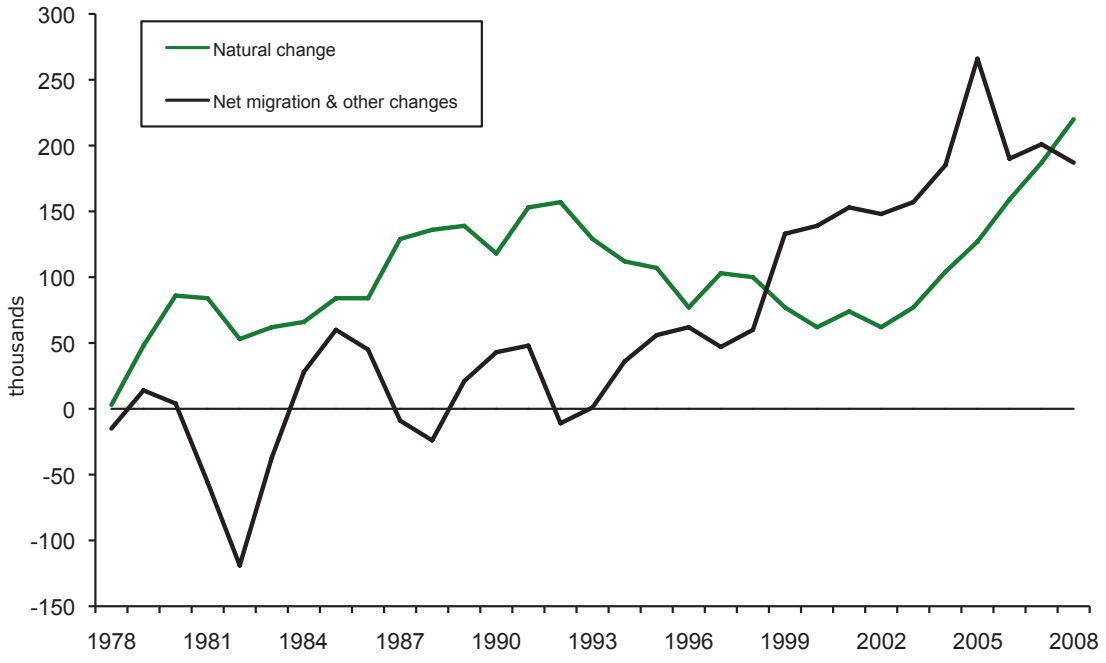
2.5 The mid-2008 based ONS projections assume long-term net migration to the UK of 180,000 annually, a reduction of 10,000 from the 2006-based projections.[7] It has been argued that international migration is largely driven by comparative economic performance,[8,9] and it remains to be seen whether or not the current level of inward migration will be sustained following a period of lower economic growth in the UK and in light of Government policies on migration. The Commission received a number of responses about the likely causes and effects of net international migration; Box 2A provides a more detailed consideration of some of the points made.

2.6 Some demographers contend that the main driving force explaining international migration patterns is economic. When economic conditions are favourable and there is a high demand for labour, then there will be a strong 'pull' factor, so that net immigration is likely. Conversely, when economic conditions worsen, as in the UK in 2008, the balance changes and net immigration falls and may become negative, as happened in the UK during the recession of 1980-83.[10]

d Natural change has increased over the mid-year periods from 2000-01 to 2008-09. This is due both to increases in the number of births and decreases in the number of deaths. However, the larger change has been seen in births, which increased from 674,000 in 2000-01 to 791,000 in 2007-08 (then fell slightly to 787,000 in the year to mid-2009). In contrast, the number of deaths has fluctuated, but fell overall from 599,000 in 2000-01 to 570,000 in 2007-08, remaining at this level in 2008-09. To note, while births are usually published on a calendar year basis (January to December), mid-year population estimates use the number of births between mid-year points (July to June) as a component of population change.[5]

e Natural change added 217,000 to the population in the year to mid-2009, slightly lower than the 2008 figure of 220,000, but, because the overall growth was lower, this was equivalent to 55% of the increase (compared to 54% in 2008). The Total Fertility Rate also decreased slightly to 1.94 in 2009. Total Fertility Rate (TFR) is defined as "the average number of children that a group of women would have if they experienced the age-specific fertility rates for a particular year throughout their child-bearing life".[6]

FIGURE 2-I
Natural change and net migration and other changes for the United Kingdom, 1978–2008[11]



BOX 2A THE IMPACT OF MIGRATION ON POPULATION NUMBERS

Between 1978 and 1994 there was, in aggregate, roughly zero net migration, so that population growth over that period was due to an excess of births over deaths. From 1994 to 2007, net inward migration was the main source of overall population growth in the UK. In 2008, net inward migration decreased sharply, falling again in the year to mid-2009, and only increasing slightly to the end of 2009, due largely to a fall in the number of people emigrating from the UK rather than an increase in the number of immigrants.[12] Estimated total long-term immigration to the UK in the year to December 2009 was 567,000 compared with the final estimate of 590,000 in the year to December 2008. Estimated total long-term emigration from the UK in the year to December 2009 was 371,000, which was 13% lower than the final estimate of 427,000 in the year to December 2008.[13] Of the 10.2 million projected increase in the UK population between 2008 and 2033, 4.6 million is due to the assumed level of net migration, 3.3 million is due to natural change assuming zero net migration and 2.4 million is due to additional natural change from the assumed level of net migration.[14] Figure 2-II shows the recent estimated rates of both immigration and emigration – net migration is the difference between the two. *continues opposite*

FIGURE 2-II
International migration to and from the UK, 1991-2008[15]

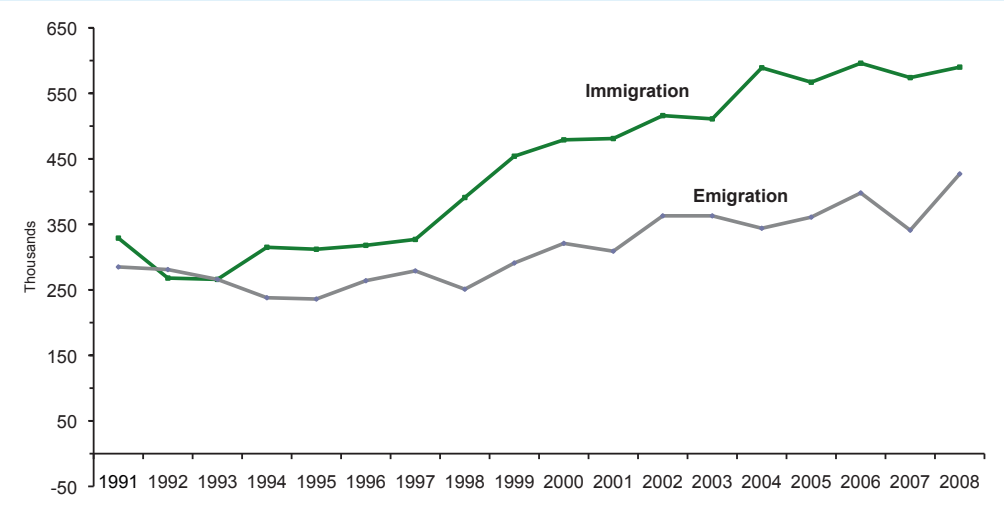
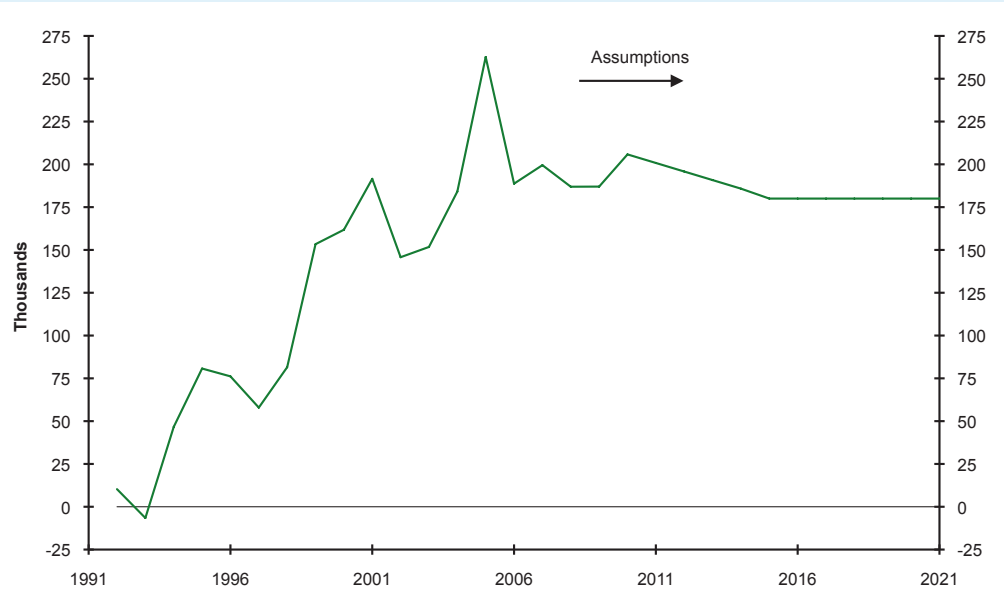


Figure 2-III shows the estimated net international migration from 1991-92 to 2008, together with a projection to 2020-21. The assumptions about future international migration have been derived from analyses of recent trends: the long-term assumption (which takes effect from 2014-15) is for net migration of 180,000 compared with 190,000 in previous projections. Special assumptions apply for the first few years of the projections: these are explained on the ONS website, and include an allowance for additional net migration (totalling 75,000 over the five years to 2009-14 from the accession countries which joined the European Union in May 2004 – the A8 countries).[16] Net migration from these countries is estimated to have fallen in the year to December 2009 by 35% and the projections assume that this decline will continue.[17] The figures for the first three years of the projection assume a gradual transition from current cross-border migration levels to the assumed long-term levels. No assumption has been made about possible future changes in Government policy or new countries joining the European Union.

FIGURE 2-III
Total net migration to the UK between 1991-92 and 2020-21, 2008-based projections[18]



2.7 The Commission heard evidence that the overall pattern of migration depends on these economic factors combined with the size of birth cohorts in earlier years.[19] In other words, if earlier birth cohorts were small, leading to a limited UK-born labour force, then for any given level of economic activity the demand for labour from abroad will be high, and inward migration will be strong: conversely larger earlier birth cohorts will tend to mean less demand for overseas labour at a given level of economic activity. Lower levels of domestic economic activity will, in this way, lead to incentives for current residents (whether UK-born or not) to leave the UK. These factors suggest that the future of the UK population will be determined in the next few years primarily by how attractive the UK will be as a place to live, and this will be largely determined by its economic performance relative to other countries. This raises the prospect that, given low total fertility rates and the possibility that the UK demand for labour may not be strong, total population size may not rise very rapidly and could at some point begin to fall.[f]

Changing age structure

2.8 Barring any major epidemic or other catastrophe, there is less uncertainty about the projected changes in the age structure of the population. Increasing life expectancy has been a major contributor to overall population numbers. The structure of the population is projected to age gradually, but the number of people in the oldest age groups will increase the fastest. According to ONS projections, the number of people over the age of 85 in the UK will more than double over the next 25 years, rising from 1.3 million in 2008, to 1.8 million by 2018, and 3.3 million by 2033 (Figure 2-IV).[20]

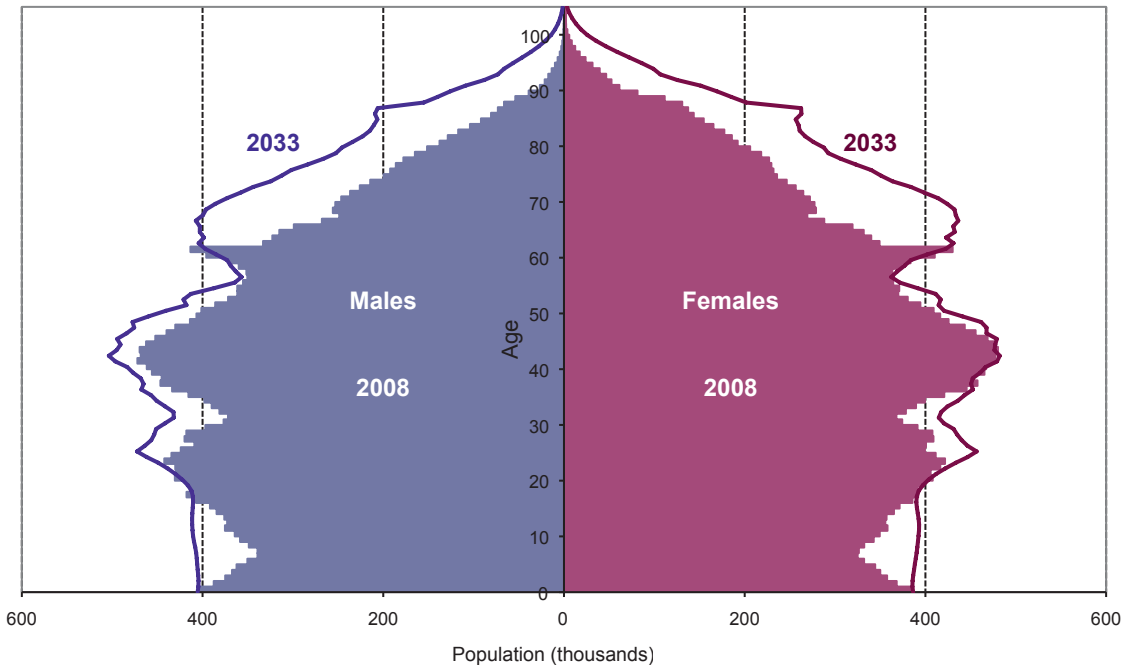
Household formation

2.9 There were 25.7 million households in the UK in 2008, equivalent to a rise of nearly 25% since the 1981 Census. During the same period, the total population grew by only 9% and the number of one-person households increased by 73% (compared to a rise of 12% in households containing more than one person).[21] This has important implications for the environment because, as well as the simple total number of households, with implications for land take, resource use, consumption and waste arisings, there is evidence to suggest that resource use per head is higher in smaller households – an issue which will be discussed in more detail in later chapters.

f The issue of relative economic performance also applies within the UK in that the availability of jobs around the country will influence the future regional distribution of the UK population; this is discussed in Chapter 4.

FIGURE 2-IV
Estimated and projected age structure of the UK population, mid-2008 and mid-2033[22]

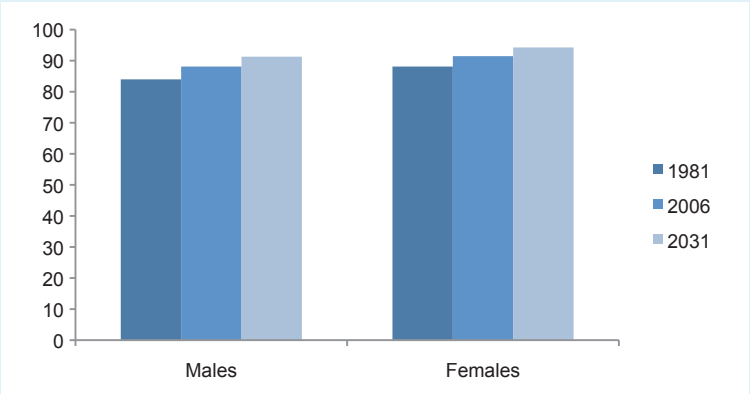
The vertical axis shows age in years of the population, population is shown on the horizontal axis in thousands.



BOX 2B INCREASING LIFESPANS

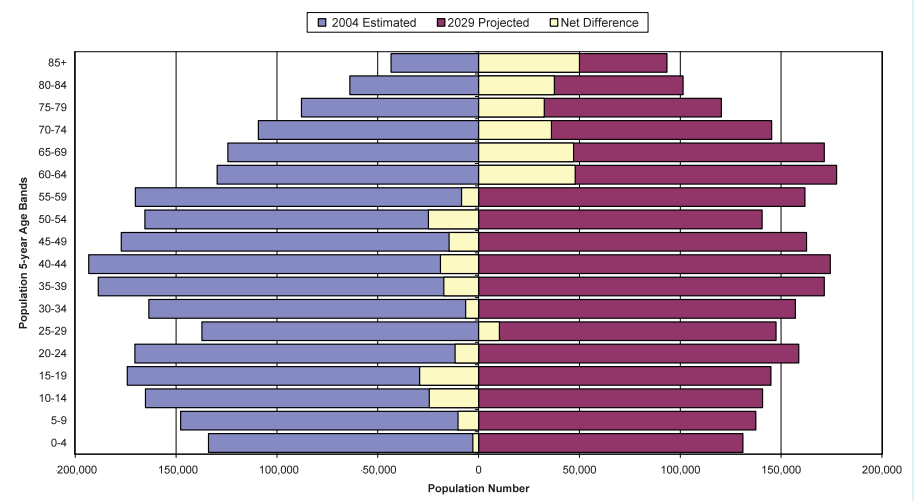
Increased lifespan is an important component of demographic change, and can cause the total population to grow even when the fertility rate is below the replacement level.[g] Allowing for the projected mortality improvements assumed in the 2006-based population projections, for example, cohort life expectancy at birth in 2006 was 88.1 years for boys and 91.5 years for girls (Figure 2-V).[23, h]

FIGURE 2-V
Cohort life expectancy at birth in the UK: 1981, 2006 and 2031[24]



The demographic implications of increased longevity can be seen in the UK in the North East region of England (where migration is particularly low). Figure 2-VI below shows that, in all age bands below 60 (with the minor exception of the 25-29 band), the population is projected to fall between 2004 and 2029, and for all bands aged 60 and above the number of people is projected to rise.[25]

FIGURE 2-VI
North East population by age group – 2004 and 2029[26]



g The replacement level is the level of fertility required to ensure that a population replaces itself in size.

h Life expectancy can be expressed in two ways, often termed 'period life expectancy' and 'cohort life expectancy'. Period life expectancy at a given age for an area is the average number of years a person would live, if he or she experienced the particular area's age-specific mortality rates for that time period throughout his or her life. It makes no allowance for any later actual or projected changes in mortality. Cohort life expectancies are calculated using age-specific mortality rates, which allow for known or projected changes in mortality in later years and are therefore regarded as a more appropriate measure of how long a person of a given age would be expected to live, on average, than period life expectancy. We have illustrated the growth in life expectancy using cohort life expectancy in this chapter.

2.10 The trends for an increase in the number of households, and for a greater proportion of these to comprise only one person, are projected to continue and strengthen to the 2030s, as shown in Table 2.1. (The process involved in projecting the number of households is detailed in Box 2G at the end of the chapter.) However, the official household projections depend on the population projections produced by ONS and so reflect at least the same level of uncertainty, as well as involving several additional assumptions which add to that uncertainty; some who submitted evidence called into question their value as a basis for spatial planning for example.[27] However, despite the uncertainty about the precise numbers, the trend is clear, and this will have significant implications.

TABLE 2.1
Household projections for England, Scotland, Wales and Northern Ireland[28,29,30,31]

Country	Year	Number of households	Year	Projected number of households	Increase
England	2006	21.5 million	2031	27.8 million	+29%
Wales	2006	1.3 million	2031	1.6 million	+25%
Scotland	2008	2.3 million	2033	2.8 million	+22%
N. Ireland	2006	672,600	2021	798,300	+19%

Summary

2.11 Each of the various aspects of demographic change summarised in 2.3-2.10 is governed by a series of complex factors, and they are inextricably inter-related. For example, the workforce required to deliver social care for an ageing population might be drawn from inward migrants, who will themselves have children and grow old in the UK. The improvements in life expectancy might lead to more older people living in one-person households. Indeed, "the majority of older people continue to live in the community well into later life; just under three quarters of people aged 90 and over were living in private households in 2001".[32] Equally, a continued increase in fertility rates might dampen the demand for inward migration. That these interconnections exist is clear – even though they may be difficult to quantify.

How robust are population estimates and projections?

2.12 Estimates of the size of the future population are inherently uncertain, and of its distribution even more so. The population figures are derived using estimates of population numbers in the middle of 2008 and a set of assumptions about future fertility, mortality and migration which are themselves based on past demographic trends. So, as ONS has made clear, the figure of 71.6 million people in the UK by 2033 is not a forecast, nor even the most likely outcome (Box 2C provides further explanation).[33] Instead, the projections "simply provide the population levels and age structure that would result if the underlying assumptions about future fertility, mortality and migration (which assume recent past trends will continue) were to be realised".[34]

BOX 2C THE NATURE OF POPULATION PROJECTIONS[35]

The following information is adapted from the 'Frequently Asked Questions' section on the ONS website.[i]

What are the national population projections?

National population projections are prepared by the Office for National Statistics (ONS) on behalf of the National Statistician and the Registrars General for Scotland and Northern Ireland. They are produced every two years and provide projections of the future size and age structure of the population for the UK and its constituent countries. The national population projections undergo regular quality assurance reviews and are produced free from political interference.

How are the projections produced?

The national population projections are based on the latest available mid-year population estimate and a set of demographic assumptions about future fertility, mortality and migration based on analysis of trends and expert advice. They are produced using the internationally accepted cohort component methodology. This method accounts for changes which increase or decrease the population (births, deaths and net migration) and models the effect of these changes and the passage of time on the age structure of the population.

Do the projections take Government policies into account?

The national population projections are not forecasts and do not attempt to predict the impact that future government policies, changing economic circumstances or other factors (whether in the UK or overseas) might have on demographic behaviour.

How are the assumptions underlying the projections agreed?

The assumptions about future levels of fertility, mortality and net migration are agreed in liaison with the Devolved Administrations... following consultation with key users of projections in each country and advice from an expert academic advisory panel. Details of the membership of the panel, minutes of its meetings and information about the assumptions behind the calculations are published online by the Office for National Statistics.

What is the latest set of national population projections?

The latest set of national population projections is the 2008-based projections published by ONS on 21 October 2009. They are based on the estimated population at the middle of 2008. The principal (central) projection is based on assumptions considered to best reflect demographic patterns at the time they were adopted. However, due to the inherent uncertainty of demographic behaviour, ONS also produces a number of variant population projections, based on alternative, but still plausible, assumptions of future fertility, mortality and migration.

How do the 2008-based projections compare with previous projections?

Compared to the previous (2006-based) projections, the long-term fertility assumption has remained the same, the life expectancy assumptions have been raised and the migration assumption has been lowered. This combination has caused a slight decrease in projected future population size compared to the previous 2006-based projections.

i Accessible at http://www.statistics.gov.uk/downloads/theme_population/NPP2008/NPPFAQ.pdf.

How accurate have past projections been?

The ONS published an analysis of the past accuracy of national population projections in 2007 in *Population Trends 128*. This analysis compared the 1955-based to 2004-based projections with estimates of the UK population up to mid-2005. The analysis found that the mean absolute error of the projected total UK population 20 years ahead was about 2.5% overall (when considering 1955-based to 1985-based projections), and lower than 2% when just the most recent (1975-based to 1985-based) projections were considered. This would correspond to around 1.4 to 1.7 million people (2.0-2.5% mean absolute error calculated on the 2008-based principal projection for 2028). The largest differences between projected and actual populations were found to be for the youngest and oldest ages, while projections of the working age population were found to be comparatively accurate.

Why were the 1955-based and 1965-based projection so inaccurate?

The 1955-based national population projections, produced prior to the 1960s baby boom, projected the lowest future population sizes of any official projection. The projected population for 1995 (40 years ahead) was 53 million, some 5 million lower than the population estimate for mid-1995. In contrast, the 1965-based projections, produced at the height of the 1960s baby boom, projected the highest future population sizes – the projected population for 2001 (36 years ahead) was 75 million, some 16 million higher than the population estimate for mid-2001. This illustrates the difficulty in projecting the population during periods of demographic change, and the importance of bearing in mind the uncertainty of projections, particularly over longer periods of time.

Why does ONS produce variant projections?

Projections are uncertain and become increasingly so the further they are carried forward in time. It is vital that users of population projections, especially those with long-term planning horizons, take account of this uncertainty in their planning. In addition to the principal (or central) projection, variant projections are therefore also published based on alternative, but still plausible, assumptions. These variant projections provide an indication of uncertainty by allowing users to consider the impact upon the population if future fertility, mortality and migration differ from the assumptions made for the principal projection. The publication of variant projections is an internationally recognised method for illustrating the uncertainty associated with population projections.

How far ahead do the projections go?

Projections are uncertain and become increasingly so the further they are carried forward in time. For this reason, analysis of the projection results mainly focuses upon the first 10 or 25 years of the projection period, which corresponds with the planning horizons of the majority of users of the projections, whilst recognising that uncertainty will be greater over a 25-year period. However, some key users require projections over a longer period, and therefore results are published for up to 75 years ahead (and available on request up to 100 years ahead).

2.13 Population estimates and projections are widely used as a basis for resource allocation, service planning and policy development. They are seen as valuable tools, particularly where users understand the uncertainty underlying the statistics and apply them with local knowledge and

analysis. However, we heard some concerns about the way in which ONS statistics were compiled and applied. For example, some respondents felt that the estimates of the number of migrants at a local level were unreliable owing to a lack of up-to-date data.[36,37] (See Box 2D for an example.[38])

2.14 ONS is aware of these concerns and has been undertaking a programme of work to improve the population and migration statistics it produces, announcing in February 2009 a package of improvements for mid-year population estimates for England and Wales, the first results of which were published in May 2010.[39] ONS recognises that it is increasingly difficult to make accurate deterministic projections, given "the openness of the economy, the complexity of financial markets, the changing nature of families, population ageing, and migration flows".[40] ONS is therefore researching the use of various approaches, including using stochastic models.

BOX 2D MIGRATION FIGURES IN LINCOLNSHIRE

The Lincolnshire Research Observatory (LRO) study on population patterns was carried out in order to gain a better understanding of the scale and impact of local migration; since population estimates generally only take account of internal and long-stay international migration, it was felt that more information was needed.

The study looked at the county population estimates produced by the ONS, together with data from National Insurance and Worker Registration schemes, and considered them in conjunction with figures taken from local General Practitioner (GP) registers. The analysis showed that the GP registers placed the county population 2% higher than the corresponding 2007 ONS population projection; this figure differed across the districts and was as high as 10% in Boston District Council.

While acknowledging that GP registrations themselves needed to be interpreted with caution, this work suggested to Lincolnshire that the ONS sub-national figures could have underestimated inward migration and, therefore, the overall population numbers at local level.

2.15 To provide an indication of the uncertainty about the central figures and to allow those using the statistics to consider different scenarios, ONS produces variant projections at the national level using different assumptions about future fertility, mortality and migration. These demonstrate that using high or low assumptions about the fertility rate would result in about 650,000 more or fewer people by 2018 and two million more or fewer by 2033; a similar range would result from varying the assumptions about migration.

2.16 While recognising that projections are increasingly uncertain the further they extend into the future, the Commission analysed these variant projections,[j] including those based on the most extreme or special case assumptions, for the period to 2083. The variant projections we considered most likely to deliver lower population numbers are illustrated in Figure 2-VII.

2.17 The lowest variant illustrates what would happen if there were no further reductions in mortality (i.e. if the long-standing trend towards longer lifespans were halted) and net migration were zero. The first assumption, at least, is of course implausible and in any case would be undesirable. But under these assumptions, the population would grow slowly, peaking in 2022, and falling slowly to return to the 2008 level by 2037. The second lowest variant shows the effect of assuming zero net migration, all other assumptions remaining as in the ONS principal projection. Under this variant, the population would reach a peak in 2034, and would not have fallen back to the 2008

j Based on the mid-2008-based population estimates published by ONS in October 2009.

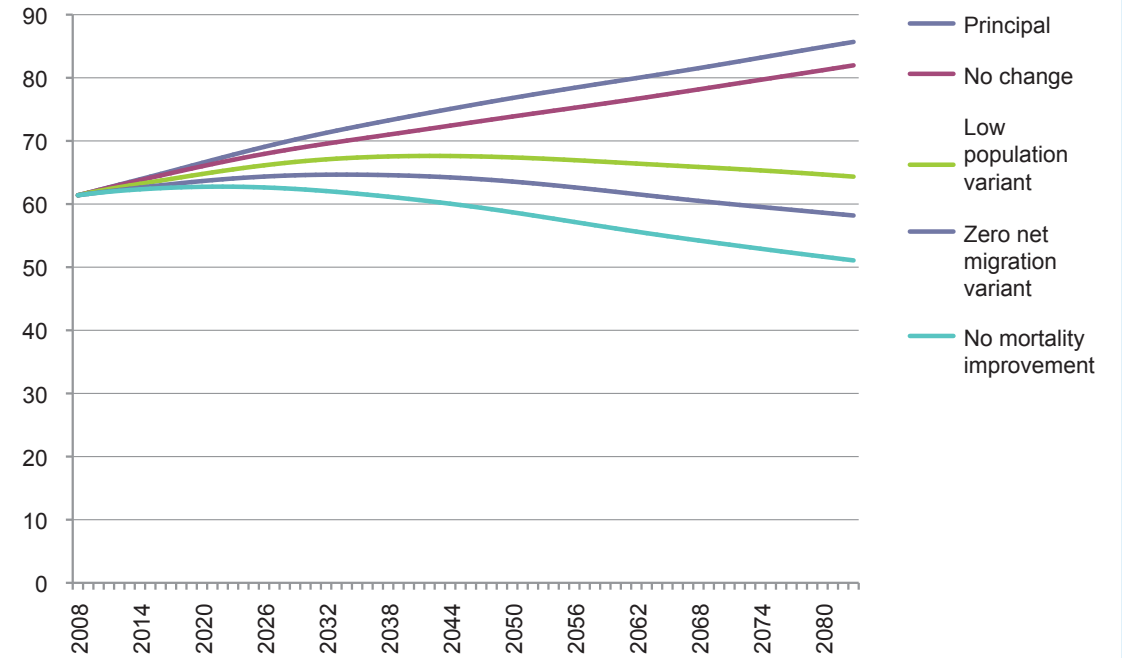
level within the 40-year horizon of this report. (In fact, it would return to this level only in 2063.) The third lowest variant shows the effect of a reduced fertility rate, no improvement in mortality, and reduced net inward migration. Under these assumptions, the population continues to grow until 2042.

2.18 In summary, the analysis suggests that even if it were possible to devise socially acceptable means of constraining population growth, this is unlikely to provide a quick or dramatic effect on the size of the UK population.

FIGURE 2-VII

Variant population projections for the UK to 2083 based on mid-2008 estimates[k]

Horizontal axis covers the period 2008 to 2083; vertical axis gives population in millions.



The **principal projection** assumes a total fertility rate of 1.84 children per woman; improvements in mortality rates of 1% a year beyond 2033 and annual net migration of 180,000.

The **low population variant** assumes a total fertility rate of 1.64 children per woman; no improvements in mortality rates beyond 2033 and annual net migration of 120,000.

The **zero net migration variant** uses the same fertility rate and mortality assumptions as the principal projection but assumes zero net migration.

In the **no change variant** assumptions are kept constant throughout the projection period; it uses a total fertility rate of 1.93 children per woman, the mortality rates as assumed for 2008-09 in the principal projection and an annual net migration figure of 180,000.

The **no mortality improvement** and **zero net migration variants** use the total fertility rate from the principal projection, the mortality rates assumed for 2008-09 in the principal projection and zero net migration.

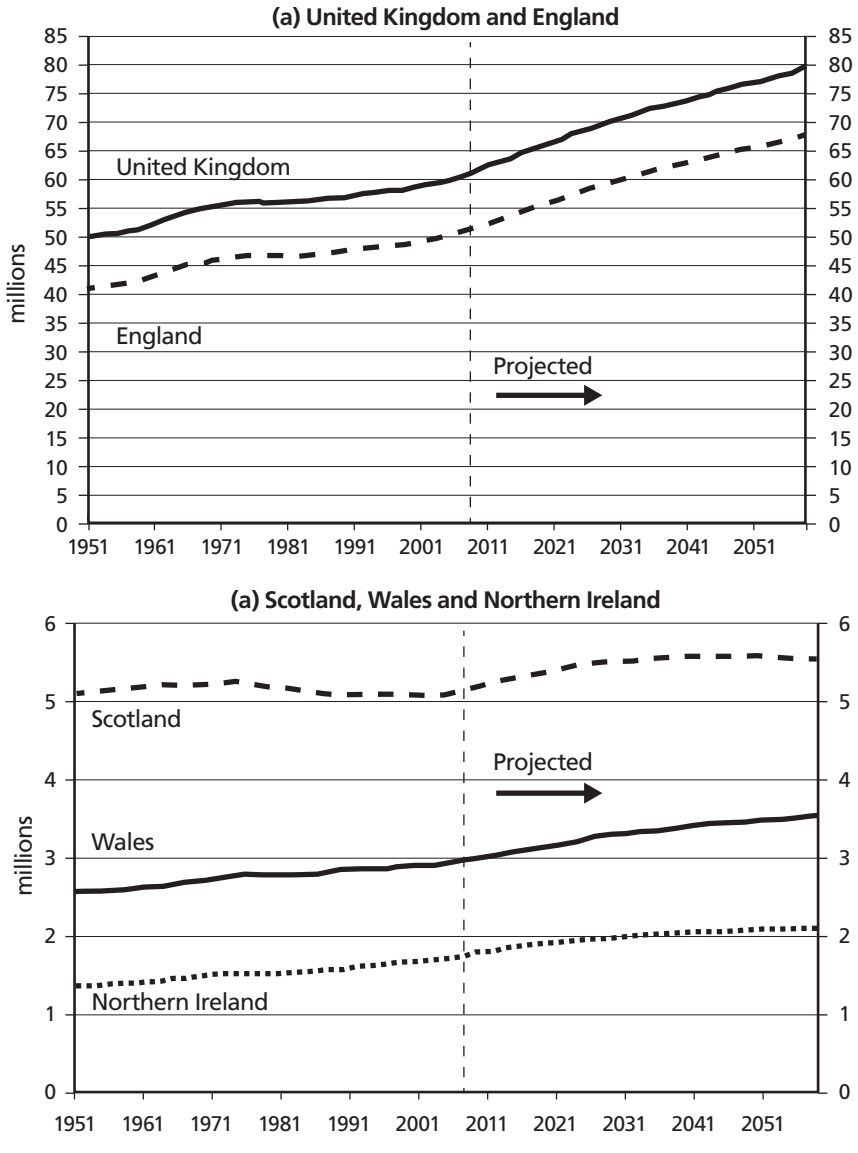
k Diagram prepared by RCEP using long-term projections kindly provided by ONS. ONS has asked us to emphasise that projections become more uncertain the further they extend into the future.

Distribution of population: A complex and varied picture

2.19 It quickly became clear to the Commission that there is very little uniformity in the way trends in demographic change apply across the UK, with differences observable by country, by region, and even within counties. 'Intensely grainy' is a simple way to describe population and net demographic changes at all scales across the UK. We decided, therefore, to examine demographic change in the UK at different scales to try to identify the nature of such variations, and to analyse the implications for future strategic planning and environmental policy development.

FIGURE 2-VIII

Actual and projected population of the United Kingdom and constituent countries, 2008-based national population projections, 1951–2051[41]



2.20 While the ONS projections suggest that there will be population increases over the next 25 years in each constituent country of the UK (as illustrated in Figure 2-VIII), the degree and impact of this trend varies considerably. Scotland, for example, has the lowest projected percentage increase of around 7% between 2008 and 2033, compared to a projected increase of 18% in England over the same period.

2.21 Given that demographic trends play out in different ways in different parts of the UK, we looked in more detail at particular areas to gain a more detailed picture of the way demographic trends might combine with the broader social and economic context to create particular pressures on or concerns for the environment. In the course of our study, we visited a number of places which exemplify the range of issues found across the UK: Inverness (part of the Highlands and Islands district of Scotland, facing the challenge of sparse and, in some areas, declining populations); Perth (facing growth, while neighbouring Dundee has seen decline); the Heads of the Valleys in South Wales (seeking regeneration after the decline of traditional industries); and Lincolnshire (a largely rural economy, with extensive migration). We also held a seminar for some of those involved in dealing with planning and infrastructure provision in London and the south-east.[1]

London and the south-east

2.22 The evidence we received in the first stage of the study indicated that continued population growth in London and the wider south-east of England would create obvious pressure on infrastructure, services and the environment (see Box 2E) and we were keen to discuss this further with those responsible for planning and service provision.

BOX 2E DEMOGRAPHIC CHANGE IN LONDON AND THE SOUTH-EAST OF ENGLAND

The population of Greater London as of October 2009 was about 7.63 million people; by 2031 this is projected to increase to 8.89 million people. From the current number of households in London (3.20 million) it is projected that there will be 3.99 million households by 2031. London's population has grown every year since 1988 – even during the severe economic downturn of the 1990s.[42]

As younger people are more likely to migrate into London from elsewhere in the UK and from overseas, the number of births in the capital is high, although age-specific fertility rates are much as the national average. The increasing size of London's population is due to the high natural change (births less deaths) of this young population rather than to net immigration.[43] In-migration to London has only exceeded out-migration once during the last eight years. In recent years, the outflow of people from London to other regions has diminished as people find it harder to move out in the current housing market. In April 2010 it was reported that net outflow from London for the previous 12-month period had decreased by nearly 36,000 people – its lowest level since 1997.[44]

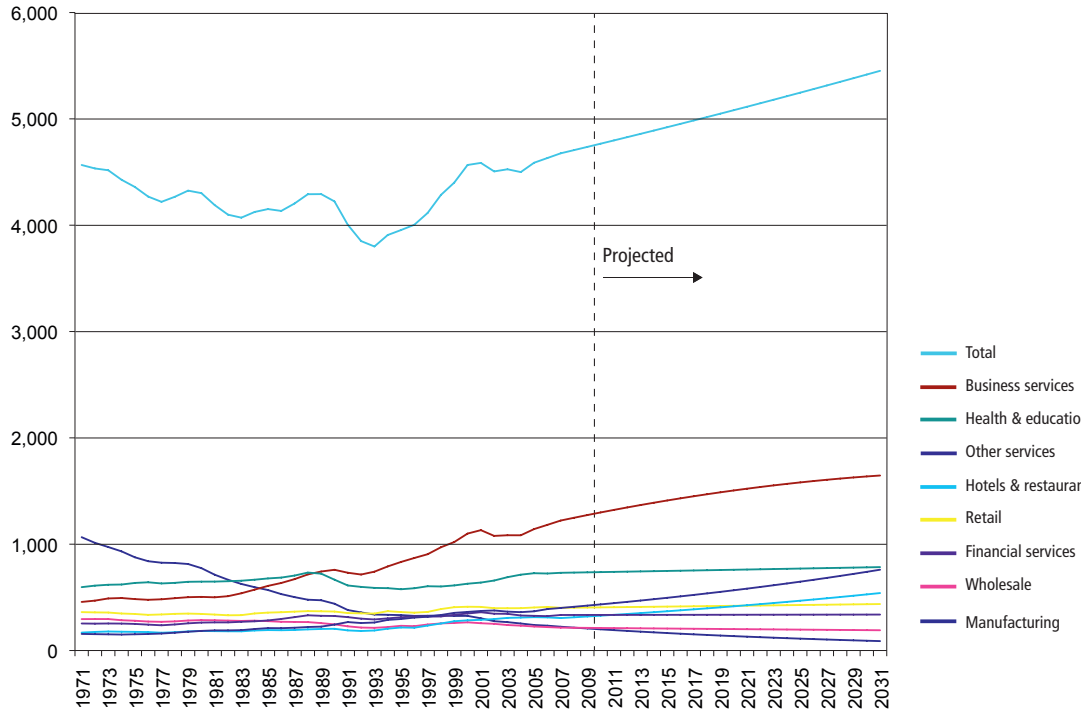
The south-east and London are hugely dependent on each other – not only is there a huge flux of people who move from London into the South East Region each year (96,000 people in 2006) and *vice versa*, but there are large daily commuter flows between London and the South East Region each day – 370,000 South East residents travel to London each day while 128,000 Londoners travel outwards to jobs in the South East Region.[45]

In mid-2006 the South East Region was home to about 8.2 million people living in 3.5 million homes. This is projected to grow by 64,300 people each year, exceeding 9.5 million people by 2026. The Regional Spatial Strategy for the South East has recognised the need for the region to accommodate an additional 39,100 dwellings per year over the period 2006-31.[46]

1 More detailed information on each of the Commission's visits can be found on our website: www.rcep.org.uk.

2.23 The London Plan[47] assumes there will be stable economic growth in the capital for the foreseeable future, which will continue to attract people to the region and therefore sustain the demand for jobs (Figure 2-IX), housing and office space.[m] While it seems very likely that London's population will grow in the future, driven mostly by growth in employment opportunities, we note that the employment projection for 2008-31 in Figure 2-IX shows straight line and continuous growth for over 20 years ahead. This kind of straight line, single-point style projection is unrealistic in a population area, relative to the UK, as small as London. There is scope for considerable variation in employment levels in London over the period to 2031 and we would have expected that to be reflected in the projections.

FIGURE 2-IX
Employment projections for London 2008-31 and historic data 1971-2007[48]



2.24 At a regional level, over the period 2008 to 2033, the South East is projected to have the largest absolute increase in population of any region in England. There are significant differences in the rate of projected population growth between the English regions, however, as shown in Figures 2-X and 2-XI. The East of England Region is projected to have the largest percentage increase, with a near 25% increase in population projected between 2008 and 2033. The effect of the differences in projected population growth could intensify the existing imbalance between the regions, which is illustrated graphically in this report's cover image, created by Benjamin Hennig from the Sasi Research Group at the University of Sheffield. The image shows the relative proportion of the population living across the UK. Densely populated areas occupy more space on the map, whereas sparsely populated areas occupy less space.

m The London Plan is a statutory document prepared by the Mayor and the Greater London Authority as the spatial plan for Greater London.

FIGURE 2-X
Projected population increase 2008-33 by English Government Office Region[49]

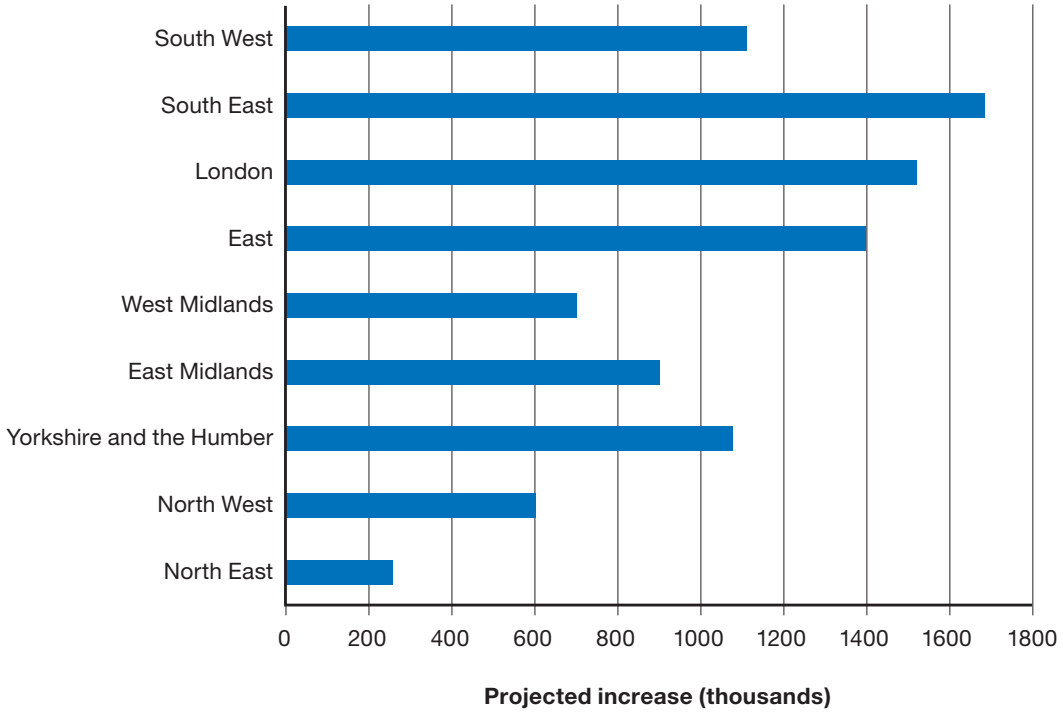
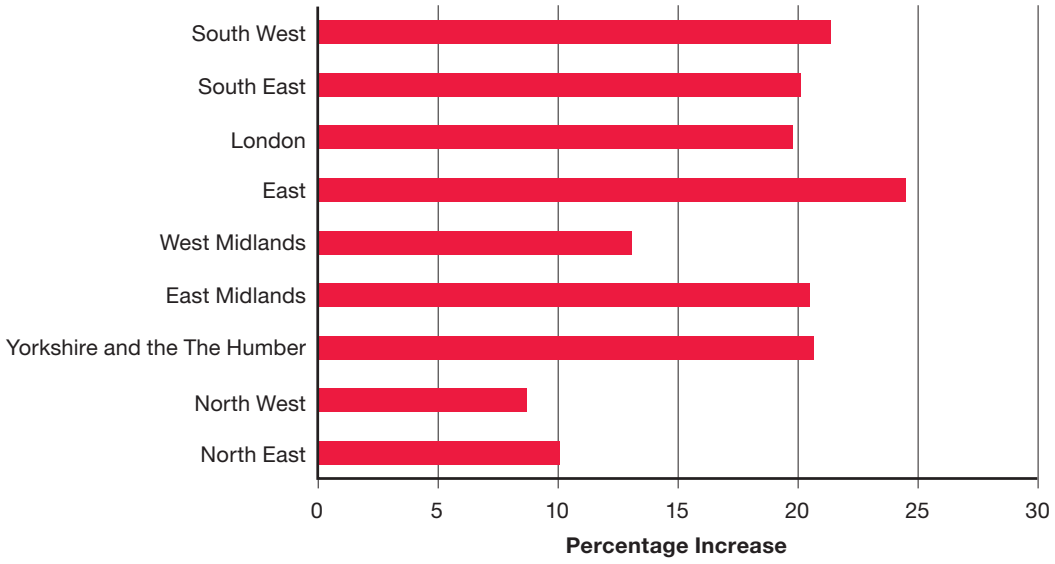


FIGURE 2-XI
Projected percentage population increase 2008-33 by English Government Office Region[50]



2.25 In all areas, demographic trends are affected by many of the same drivers, but there are important differences in the way these play out in the specific local context. Since many environmental impacts are felt most strongly at a local level, we were particularly interested to explore the effects of local differences. Location, history, social and economic context, and local constraints are all part of a complex mix.

Lincolnshire

2.26 The Commission decided that Lincolnshire – seen by some as close enough to the South East region to be affected by its expansion[51] – would provide an instructive example of demographic change at a local level, because the county had experienced more rapid population change than most other areas of the UK in recent years, and because we were aware that some detailed work on migration figures had already been carried out to enable local service providers to gain a better understanding of demographic changes in the area.

2.27 The official estimates showed an increase of 7% in the population of Lincolnshire between 2001 and 2007, although we received evidence indicating that there was considerable local variation in demographic trends across the county, with growth rates ranging from 1% (in Stamford) to 14% (in Sleaford). Age distribution also varied across the county with the trend being for a net movement of younger people westwards or out of Lincolnshire and older residents tending to live in the eastern half of the county and along the coast. The detailed work carried out by the Lincoln Research Observatory (Box 2D) provides a striking example of the wide variation in population composition and dynamics across just one county and a practical illustration of the challenges facing local authorities seeking to deliver services against a background of demographic change.

Scotland

2.28 The Commission visited Scotland to find out more about the challenges and opportunities presented by demographic change in the Highlands and Islands, and, by contrast, in the Tayside area around Perth and Dundee. The Scottish Government has an Economic Strategy[52] which encourages inward migration to Scotland.

2.29 On our visit to Inverness and the Highlands, we heard that the slight increase in total population over the past decade masks considerable variation. The population in the inner Moray Firth area, for example (which incorporates Inverness and its surrounds), has experienced significant population growth, whereas parts of the Western Isles, and Caithness and Sutherland to the northern part of the Highland Region, have witnessed population declines. Within the Highlands and Islands, there has been a general trend of population movement to more major settlements, or to areas that are easily accessible to them. This trend has been observed in Lewis, for instance, where the population has become more concentrated around Stornoway[53] (with employment, services and transport opportunities), as well as in the Shetland Isles, where there has been a movement of population to areas within a short commute of Lerwick.[54]

2.30 In the Dundee City region, which covers the local authority areas of Dundee, Angus, Perth and Kinross, and the parliamentary constituency area of North East Fife, there has also been considerable variation in demographic changes. Since the turn of the century, there has been population growth within Perth and Kinross, and North East Fife, but long-term decline in Dundee and Angus, although the populations in these areas have stabilised in recent years.[55] During the Commission's visit to Perth, it was emphasised that the city of Dundee is still making the transition to a post-industrial city. Many of those with the financial means to do so appear to be moving to surrounding areas, accessible to the city – to Perth and Kinross for example, where

population increased by 7.1% in the period 1998-2008. Overall, despite natural change remaining negative, the population in the Dundee City region has been slowly increasing since 2003, due to increased inward migration. The population of the region is expected to continue to increase by 1% in the period up to 2018 – slower than the growth of 3% projected for Scotland, and the 7% projected for the UK. Scottish Enterprise expects the number of in-migrants to the Dundee City region to fall below the projected 2018 figures suggested by the General Register Office for Scotland due to a decrease in economic activity.[56]

Small towns, rural areas and cities

2.31 More generally, evidence submitted during the first stage of our study suggested that, not withstanding loss of population in some remote areas, there has been faster than average population growth of small towns and more rural areas,[n] highlighting the consequent implications for transport-related pollution of a continuing urban to rural shift.[57] We also heard that the population in rural and coastal areas is generally older than in towns and cities, and that this trend is likely to continue even more strongly in future.[58] The number of people living in the countryside who are aged 85 or over is projected to treble in the period to 2028. However, nearly 8 out of every 10 people in the UK lived in an urban area in 2001 and nearly 41% of these urban dwellers lived in one of the 10 most populous urban areas.[59] A common characteristic of these areas is a relatively high proportion of young adults.

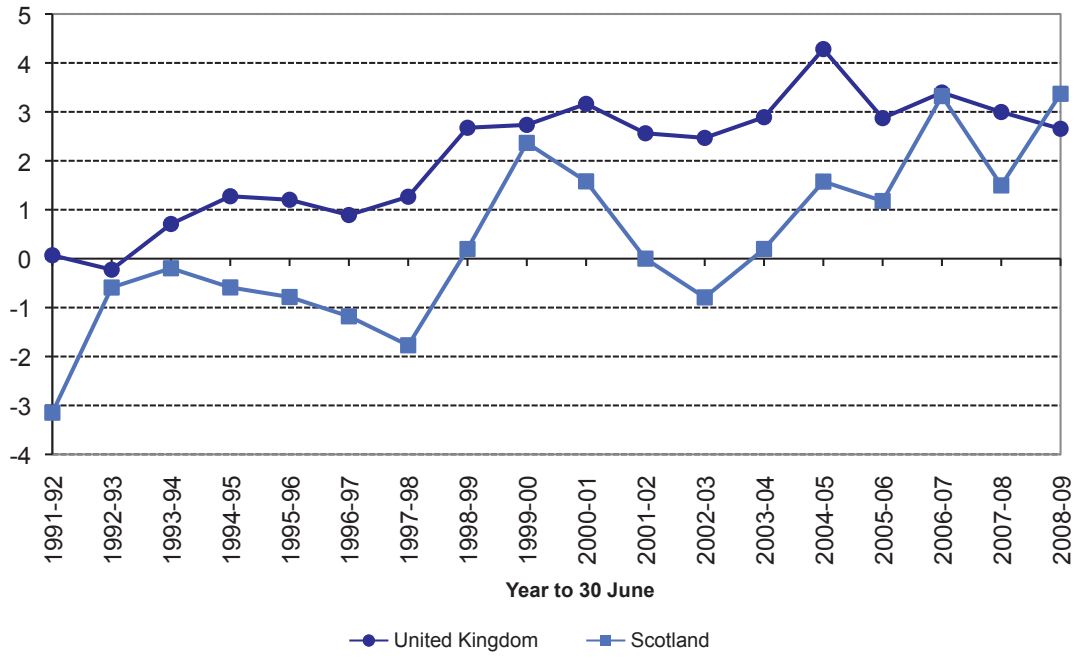
Migration and seasonal change

2.32 The amount of international migration is another aspect of demographic change that varies considerably across the constituent countries of the UK. As an example, Figure 2-XII compares the trends in Scotland against those in the UK as a whole, and shows how the number of migrants has generally been proportionately lower in Scotland than elsewhere.

2.33 Focus on net inward international migration as a driver of population change can overlook the scale and significance of population movement within the UK. Net migration is the difference between the number of people moving into a country (or local area) and the number moving out, but it gives no measure of the actual numbers of moves taking place (i.e. the 'churn') and may mask differences in the characteristics of those moving. For example, retired couples moving from a town to a more rural area or to the coast are likely to have different household requirements and a different lifestyle to students or recent graduates moving to a town to study or to begin their working lives. In the same way, the different characteristics and expectations of those coming to the UK from abroad and those who leave will affect household formation and service requirements.

n Much of this movement being to areas often referred to as 'accessible rural', by virtue of their ease of access to urban centres.

FIGURE 2-XII
Net total international migration per 1000 population, 1991-2009, Scotland and UK[60]



2.34 In addition to managing the impacts of long-term migration, local authorities and service providers have to cope with the effects of short-term movements, be they daily (commuters living in suburbs or rural areas and travelling into urban centres to work), weekly (second-home owners or weekend visitors) or seasonal (holiday makers or seasonal workers). According to a Highlands and Islands Enterprise report, there were around 2.7 million trips to the Highlands and Islands of Scotland in 2005 from visitors from the UK and abroad.[61] The effect of such ebbs and flows is far from uniform, though we heard that the costs involved are seldom adequately catered for within the resource allocations to local authorities and that, in some cases, authorities cope with the pressures of seasonal fluctuations at the expense of other areas of service provision.[62] It is also clear that any rapid change in the population can cause problems for local authorities in providing services.

2.35 Movement into and out of London, both from international migrants and moves within the UK, creates a continual churn effect. In a typical year, London receives a net inflow of international migrants from outside the UK, since more people arrive to live in London from overseas than leave. There are usually more people leaving the capital to live elsewhere in the UK than arrive from elsewhere in the UK. Between mid-2008 and mid-2009, ONS statistics showed around 156,000 people moved from overseas to live in London, and a further 205,000 came into London from elsewhere in the UK. In the same period, 117,000 people left London to live overseas, giving a net inflow of international migrants into London of 40,000, whereas 237,000 left to live elsewhere in the UK giving a net outflow of people moving within the UK. The combined impact of these two net flows was a net inflow and the impact on the age structure was to keep a young age profile in London because people arriving are typically younger than people leaving. Despite the dynamic nature of migration, there are some consistent patterns. The largest inter-regional movements in the UK since 2002 have been from London to the South East and East of England Regions

(around 30,000 to 40,000 per annum into each region). In addition, the other major movement has been from all areas of the UK to the South West Region which gained around 230,000 people between mid-2002 and mid-2009.[63]

2.36 In Lincolnshire also, much of the population growth has been driven by inward migration, both from overseas and from elsewhere in the UK, including students and members of the armed forces. It has been estimated that 20,000 people leave and between 25,000 and 30,000 move into Lincolnshire each year[64] – so a net movement of between 5,000 and 10,000 people masks over 45,000 individual moves. The Commission also heard that many of the people living in Lincolnshire's coastal zone may not be registered with a GP or may live permanently in caravans intended for holiday use, and are therefore uncounted.[o]

Changing age structure

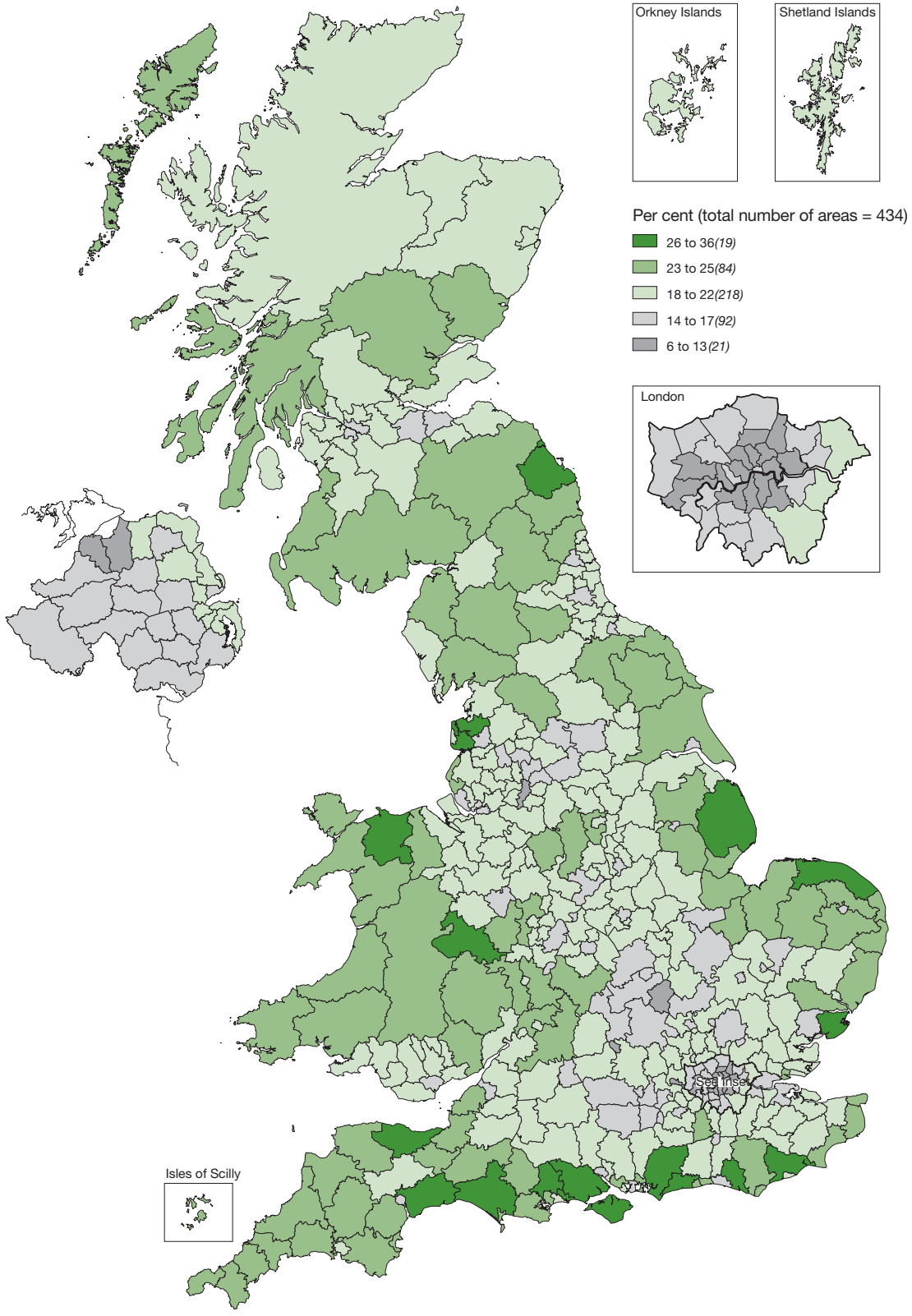
2.37 The trend towards a changing age structure applies in all countries of the UK.[65] However, the proportion of older people is increasing in Wales most quickly because, although it has experienced similar fertility and mortality rates to the rest of the UK, these have been outweighed by a high degree of outward migration of younger people. Scotland also has an older population than the UK average (even though it has a lower life expectancy) because it has had consistently lower fertility rates than the rest of the UK population. But, within every country, there is huge spatial variation in the age structure, as can be seen in Figure 2-XIII. The relatively young age structure of London's population does not reflect the general UK trend: the five least aged local authorities – each with less than 12% of their population over state pensionable age – were all London Boroughs in 2007. However, the population structure of the south-east of England is ageing: over 64% of the population growth in the 20 years to 2026 is projected to come from those who are or will be aged 60 or above. The pattern of middle-aged or retired people moving to the countryside, coupled with the out-migration of young people, has led to particularly 'top-heavy' age structures in some rural parts of the Highlands and Islands, particularly in remote areas. There tend to be particularly low proportions of pensioners in accessible rural areas within commuting distance of major cities. In contrast, in more peripheral and remote areas, the proportion of pensioners to working age people is very high, as in Sutherland and the Outer Hebrides, for instance – areas where the population as a whole is in decline.

The global picture

2.38 Although the Commission decided that this study should focus on the environmental impact in the UK of population trends within the UK itself, it is important to bear in mind the broader picture: global climate change and environmental pollution do not respect national boundaries; the protection of biodiversity is international in scope; and given the intricate nature of global supply chains, many of the resources on which the UK relies could be threatened by changes occurring elsewhere in the world. By the same token, the way individuals live and consume in the UK will have an impact on the global environment.

o The Commission heard that there were up to 40,000 static caravans in the coastal strip around Mablethorpe and that many of these are situated against the sea wall on land below sea level and occupied on a residential basis throughout the year. At the time of the Commission's visit in March 2010, the Environment Agency was carrying out a study to get a better estimate of the number of people involved.

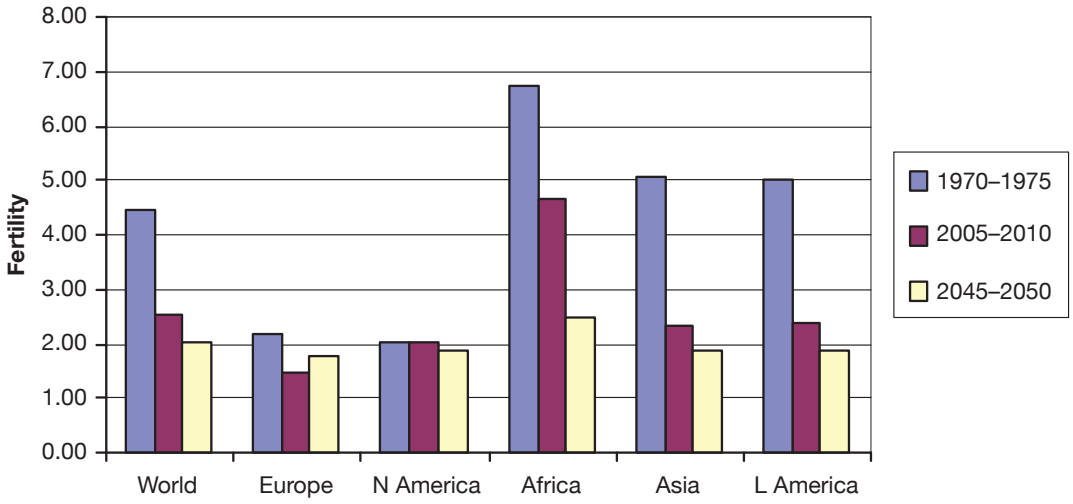
FIGURE 2-XIII
Percentage of people of state pensionable age in the United Kingdom, by unitary and local authority in 2007[66]



2.39 On this broader scale, while global population numbers are rising – and, according to figures published by the United Nations in March 2009, the world population is projected to exceed 9 billion by 2050 – the rate of global population increase is expected to moderate significantly in the longer term. As illustrated in Figure 2-XIV, fertility levels[p] are falling to below replacement levels in many heavily populated parts of the world. As a result, the rate of growth of the global population is falling in all regions, as illustrated in Figure 2-XV. A leader article in *The Economist* in autumn 2009 noted that "sometime between 2020 and 2050 the world's fertility rate will fall below the global replacement rate" and concludes that "population growth is already slowing almost as fast as it naturally could".[67] Continuing to provide access to reproductive health advice and support for the education of women in developing countries will clearly make an important contribution to this trend.

FIGURE 2-XIV
Global fertility decline 1970–2050[68]

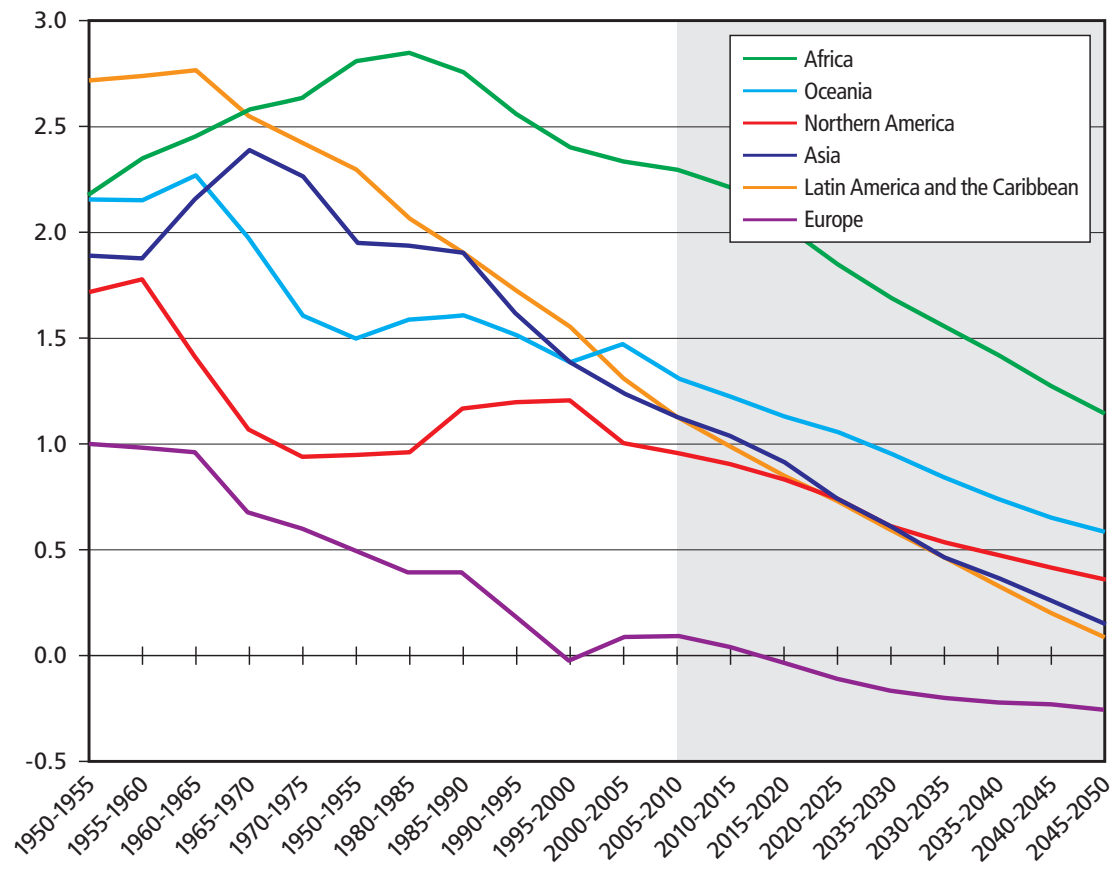
The vertical axis shows fertility as the number of children per woman



2.40 There has been much debate about whether environmental change in other parts of the world – particularly those likely to be affected most seriously by climate change – will lead to increased migration into the UK. Academics hold diametrically opposed views about whether environmental change is a driver of long-distance migration; Box 2F summarises very briefly some of the views. The Commission has concluded that environmental change in itself is unlikely to result in a significant number of migrants to the UK in the period to 2050 and has therefore decided not to consider this issue further. Moreover, international migration is being examined separately in a Government Office for Science Foresight study.[69]

p In Figure 2-XIV, the term 'fertility' follows the United Nations Population Division definition. It therefore represents the number of births, not the number of conceptions.

FIGURE 2-XV
Annual rate of population change by major geographical area[70]



Summary

2.41 In summary, the projections suggest that the UK is likely to see a number of demographic trends continue over the coming decades:

- The total number of people will continue to grow, and at a rate which is faster than over the last twenty years;
- Life expectancy will continue to increase, so the population will be on average older, and the number of older and very old people will grow faster than the population as a whole;
- People will live in smaller households on average, and so the number of households will grow faster than the population; and
- The pattern of demographic change is far from uniform – indeed, it is highly variable, according to local circumstances.

2.42 These are projections, rather than forecasts, and it is important to remember that there is considerable uncertainty about what may actually happen, and that the uncertainty is greater the more years ahead being considered, or the smaller the geographical area. Indeed, some of the components of demographic change such as net migration are tied up with factors such as the rate of economic growth. But even if there is uncertainty about the precise numbers, and it may be that some of the projections are too high, there is no doubt about the direction of travel. Indeed only by making implausible assumptions, or assumptions which would be undesirable, is it possible to

generate projections which show a falling UK population even in the medium term. It is therefore important to examine the environmental implications of the demographic changes described in this chapter.

BOX 2F ENVIRONMENTAL MIGRANTS

There has been much debate over whether changing environmental conditions are likely to cause large-scale migration, and whether a large number of 'environmental refugees' might seek to come to Europe. Academics hold diametrically opposed views about whether environmental factors themselves are a driver of migration over long distances.

A policy briefing, *Environmentally Displaced People*, by academics based at the Refugee Studies Centre at Oxford University noted that:[71]

> "In 1990, the Intergovernmental Panel on Climate Change (IPCC) predicted that 'the gravest effects of climate change may be those on human migration as millions are displaced by shoreline erosion, coastal flooding and severe drought'. Subsequent research has demonstrated that climate change will have increasingly dramatic impacts on ecological and social systems. Pessimists have predicted dramatic population movements, political instability, conflict, a vast level of human suffering and intense pressure on receiving societies."

Professor Norman Myers, of the University of Oxford, wrote in 2005:[72]

> "Developed countries cannot isolate themselves from distress and disaster in developing countries: already there are sizeable numbers of environmental refugees who have made their way, usually illegally, into [Organization for Security and Co-operation in Europe] countries and today's stream will surely come to be regarded as a trickle when compared with the floods that will ensue in decades ahead."

Although there is limited reliable data, some academics expect the scale of such flows, both internal and cross-border, to rise significantly over the next decades. Professor Myers has suggested that up to 200 million people could be on the move due to environmental factors by 2050.[73] But the forecasts vary by a factor of 40 (between 25 million and one billion), and largely depend on which of the climate change scenarios put forward by the Intergovernmental Panel on Climate Change will materialise.

The term 'environmental refugee' is itself contentious. Professor Richard Black, of the University of Sussex, for example, has argued that:[74]

> "Although environmental degradation and catastrophe may be important factors in the decision to migrate, and issues of concern in their own right, their conceptualisation as a primary cause of forced displacement is unhelpful and unsound intellectually, and unnecessary in practical terms … the linkages between environmental change, conflict and refugees remain to be proven … rather, migration is … perhaps better seen as a customary coping strategy."

Ms Gunvor Jónsson, at the International Migration Institute at Oxford, has noted that long-distance migration requires capacity and resources to organise, and that these are in short supply during periods of environmental stress. She argues it is complex, if not impossible, to isolate the effects of environmental change from other processes affecting migration (including social, cultural, economic and political processes), since most natural processes are intertwined with social processes.[75]

It would be difficult to monitor the arrival of environmental refugees in the UK. International law does not recognise environmental stress as a basis for a claim of refugee status, and this might encourage migrants to emphasise the personal security component of their plight even if environmental factors may have contributed to their decision to move. Furthermore, those with freedom of movement within the EU may choose to migrate, on the basis of environmental factors, but would not require refugee status to do so.

BOX 2G CALCULATING HOUSEHOLD PROJECTIONS IN THE UK

Household projections are generated by the Department for Communities and Local Government (CLG) in England using a 'household projection model'. The model uses the most recent available Office for National Statistics (ONS) sub-national population projections to produce trend-based projections that indicate the number of additional households that would form if recent demographic trends continue. These projections are important in supporting policy development and enabling regional and local bodies to plan their housing and other services.

CLG's household projections are projections, not predictions, of the future household numbers should current trends in population growth and household composition and size, continue. They do not take into account future policy initiatives or economic predictions.

The following paragraphs contain information about how the housing projections in the UK have been calculated. The most recent projections for each country were shown earlier in this chapter (Table 2.1).

Calculating household projections in the UK

The current household projection model used in England (HOPS) applies projected household representative rates (HRRs) to a projection of the private household population disaggregated by age, sex and marital/cohabitation status and then sums the resulting projections of household representatives. This is a six-stage process:[76]

- **population projections** are taken from the ONS national and sub-national population projections;
- **marital status projections** (*de jure* and *de facto*) at the national level are taken from ONS. Changes at the sub-national level are assumed to follow the national pattern;
- the **institutional population** is either assumed to stay at a constant level (for younger age groups) or at a constant share (older age groups);
- the institutional population is deducted from the total population to give the household population;
- **household representative rates** (HRRs) are extrapolated at the age/sex/marital status level and the resultant projections are applied to the household population by age/sex/marital status and are then summed across age/sex/marital status groups to give total household numbers;
- **regional controlling** initially takes place independently at the national, regional and sub-regional levels, with regional projections being adjusted (constrained) to be in line with the national projections and sub-regional projections being adjusted to be in line with the regional projections.

CLG planned to publish the 2008-based household projections (in line with the 2008-based ONS population projections) in autumn 2010. The projections will be produced to local authority district level, and will follow a format similar to previous projections. As the projections are national statistics, and a key part of the evidence base for national and local housing plans, CLG does not intend to change the outputs.

In December 2008 CLG commissioned a review of the methodology used to produce household projections in England. The report details the drawbacks of the current system and reviews alternative methodologies.[77]

The responsibility for producing household projections has been devolved to each country of the UK. The Devolved Administrations use different projection releases and models (and therefore assumptions) to the model used in England.[78,79,80]

The population and household projections are one of the sources of data used by infrastructure providers and the planning authorities as the basis for preparing their spatial plans. Local authorities use additional forms of demographic information to make decisions on the provision of other local services.

Chapter 3

Environmental implications of demographic change

3.1 In Chapter 2 we summarised recent demographic changes in the UK and those projected to take place over the coming years. In this and the following chapter, we seek to link these changes to the environmental impacts which might flow from them. The relationship between demographic change and the environment is complex, because there are many confounding factors in play, and often the links between demographic change in the UK and their environmental impact have not been fully explored or considered in an integrated way. As a result, we have seen little empirical evidence to support firm conclusions. However, we have gathered some information about the possible implications of demographic change for water consumption, waste generation, carbon emissions and other factors, which illustrate our main findings.

3.2 In this chapter we concentrate on the broad relationships between population size, ageing, household structure, spatial distribution and consumption patterns, and the resulting environmental impacts. In the next chapter, we will consider the impact that the uneven distribution of the increase in the number of households can have on environmental resources; we then discuss environmental constraints.

The relationship between demography and environmental impact

3.3 Commentators have suggested that the environmental impact of a population can be expressed by the formula:

$$I = P \times A \times T$$

where 'I' represents the human impact on the environment, 'P' represents the population, 'A' represents the affluence or consumption per head, and 'T' represents technology or the environmental impact per unit of consumption.[1,a]

3.4 The IPAT formula identifies three key factors in determining the impact of a population on the environment – the number of people, the amount each of them consumes, and the impact on the environment of creating each unit of consumption. It is a useful starting point for considering these issues, but in reality the situation is more complex than the formula suggests for a number of reasons. The formula most closely represents the situation where an environmental impact flows directly from consumption, for example, in identifying the greenhouse gas emissions associated with electricity use. It is less useful in, for example, assessing the impact which a population will have on biodiversity, where the causal link between consumption and impact is less direct.

a The formula was developed in the 1970s during the course of a debate between Barry Commoner, Paul R. Ehrlich and John Holdren. Commoner argued that environmental impacts in the United States were caused primarily by changes in its production technology following World War II, while Ehrlich and Holdren argued that all three factors were important and emphasised in particular the role of population growth.

3.5 Moreover, the variables are not independent: as we noted in Chapter 2, the level of net immigration is related to the level of economic activity, and the amount which can be invested in improved technology also depends on affluence, so not only 'A' but 'P' and 'T' as well are potentially influenced to some extent by economic growth. Further, unless applied at the global level, the formula does not capture the environmental impact of consumption in the UK of products which are produced abroad.

3.6 Perhaps most significantly, by focusing on averages, the formula also obscures variation in the impact of different individuals. As we explained in Chapter 2, there are a number of key projected demographic trends – a gradual increase in the number of people in the UK; a faster increase in the number of older people; an increase in the average age of the population as people live longer; and a faster increase in the number of households, in particular the number of one-person households. Coupled with this, the pattern of demographic change will not be uniform; some areas will grow faster than others, and conversely some areas will see depopulation. A focus on total population alone may miss the differential effects arising from different consumption patterns of people of different ages, or in households of different sizes, and the different implications of population growth in one part of the country as opposed to another. We examine some of the evidence for these different effects in this chapter and the next.

3.7 A focus on average levels of consumption may also obscure differences in lifestyle. Different people will consume more or less according to their personal circumstances – their individual affluence, where they live, the stage of their life and their personal priorities. We present evidence on these factors later in the chapter.

3.8 But despite these caveats, the IPAT formula does provide a framework for thinking about the relationship between environmental impacts and demographic change, and for thinking about the action which Government and others might take in order to limit environmental impacts. Box 3A illustrates how the IPAT approach can be used to understand how different drivers have influenced UK carbon emissions over the last 20 years, and shows the relative significance of the different factors in the formula.

3.9 It follows from the IPAT formula that any policies which are aimed at limiting environmental impacts cannot focus on one of the three factors 'P', 'A' or 'T' alone, since it is their combination which matters – there is no 'optimum' level of any one component. The different factors may be more or less important in the scale of their change over the next 40 years, and will be more or less susceptible to influence by policy interventions, and this is important when deciding where to focus policy responses to environmental challenges.

3.10 Since the time of the Population Panel, the UK's national income[b] has grown between 1971 and 2008 by 126%.[2] The total population grew over the same period from 55.9 million to 61.4 million, i.e. by about 10%.[3] In the crude terms of the IPAT formula, income growth has had more than 12 times the environmental impact of population growth over this period.

b As measured by gross value added, 1971-2008, in constant 2006 prices.

3.11 This is borne out, for example, by statistics demonstrating the growth in mobility. During this time, the number of private cars has increased by 159%,[4,c] and the number of people passing through UK airports has grown by 574%.[5] It is true that technology has also changed during this time, so that cars have become more fuel efficient and less polluting for example, but not so much so that the aggregate fuel consumption has fallen.

3.12 We set out in the following paragraphs illustrations of environmental impacts associated with the main projected demographic changes. We have drawn examples from historic evidence about water consumption, waste generation, greenhouse gas emissions, and air and water pollution. We have also summarised some information about the relationship between affluence and consumption, to illustrate the importance of the 'A' factor in the IPAT formula. Finally, we comment on the impacts on biodiversity – the links between population and the impact on biodiversity are less direct, so the analysis is not as clear, but the impacts are important nevertheless.

BOX 3A FACTORS INFLUENCING GREENHOUSE GAS EMISSIONS

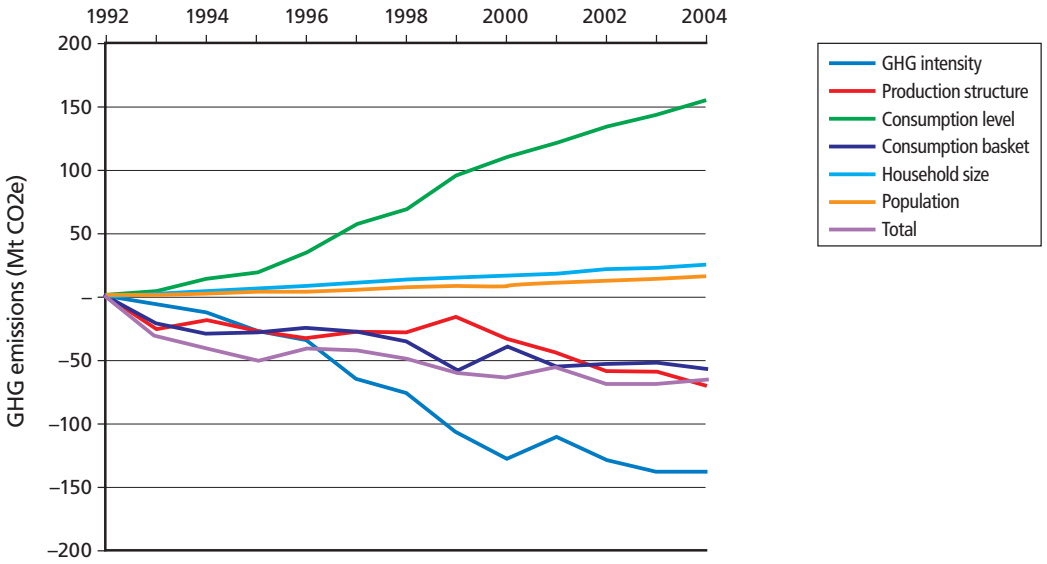
The IPAT formula can be illustrated using as an example an analysis of the different factors which influence greenhouse gas (GHG) emissions from UK sources. Figure 3-I, taken from the work of the Stockholm Environment Institute for the Waste Resources Action Programme, shows six component factors which influence total emissions of GHGs from the UK. (This is different from the GHG emissions due to UK consumption, which would need to reflect emissions elsewhere in the world in producing goods imported into the UK, less the emissions in the UK of exported goods.) These can be grouped to reflect the three terms in the formula:

- Two related to demography, that is the 'P' element of the formula – the total population (which has been rising slightly), and the differential effect of the falling average household size (which tends to increase demand for energy per head and which has contributed a roughly similar amount to the overall change in total emissions as the rise in population).
- Two related to affluence, the 'A' element – changes in consumption levels (a major driver towards increased emissions, and far more significant than the combined effect of the two demographic drivers) and changes in the consumption basket (which have tended to reduce emissions).
- Two related to technology, the 'T' element – changes in GHG intensity, i.e. the emissions associated with each unit of production (the biggest driver towards lower emissions) and changes in the UK production structure (again, a driver towards lower emissions). This last driver reflects the fact that our level of imports of industrial goods has grown, and globally must be offset against the increased emissions in other parts of the world where our imports are manufactured.

c This statistic is for Great Britain (reflecting the territorial coverage of the Department for Transport statistical series).

FIGURE 3-I
Drivers behind changes in cumulative greenhouse gas emissions from sources in the UK [6,d]

Greenhouse gas intensity is the measure of emissions per unit of production and the production structure of the economy represents interactions between all sectors in the economy. Consumption level is the level of consumer spend in pounds and the consumption basket is the level of consumer spend on products.



Growth in total population

3.13 As described in Chapter 2, Office for National Statistics (ONS) projections suggest a population increase from 61.4 million people in 2008 to 71.6 million in 2033.[7] Although population growth is generally perceived to lead to greater environmental impacts, the relationship is complex and not linear.

Waste produced by households

3.14 One of the most obvious impacts of human activity is the generation of waste, with excessive or badly managed waste representing a loss of valuable resources and potentially causing environmental damage. Government policies over the last decade in particular have sought to maximise efficiency of resource use and minimise damage by reducing waste (for example, by cutting out unnecessary packaging), by promoting reuse, recycling and composting (not least through placing challenging targets on local authorities), and by supporting the generation of energy from waste. The EU Landfill Directive has been a strong driver for many of the policies. Landfill represents a waste of resources that could be recycled or reused, it can blight land and limit its future use, and it generates methane, a powerful greenhouse gas which needs to be managed in the long term.

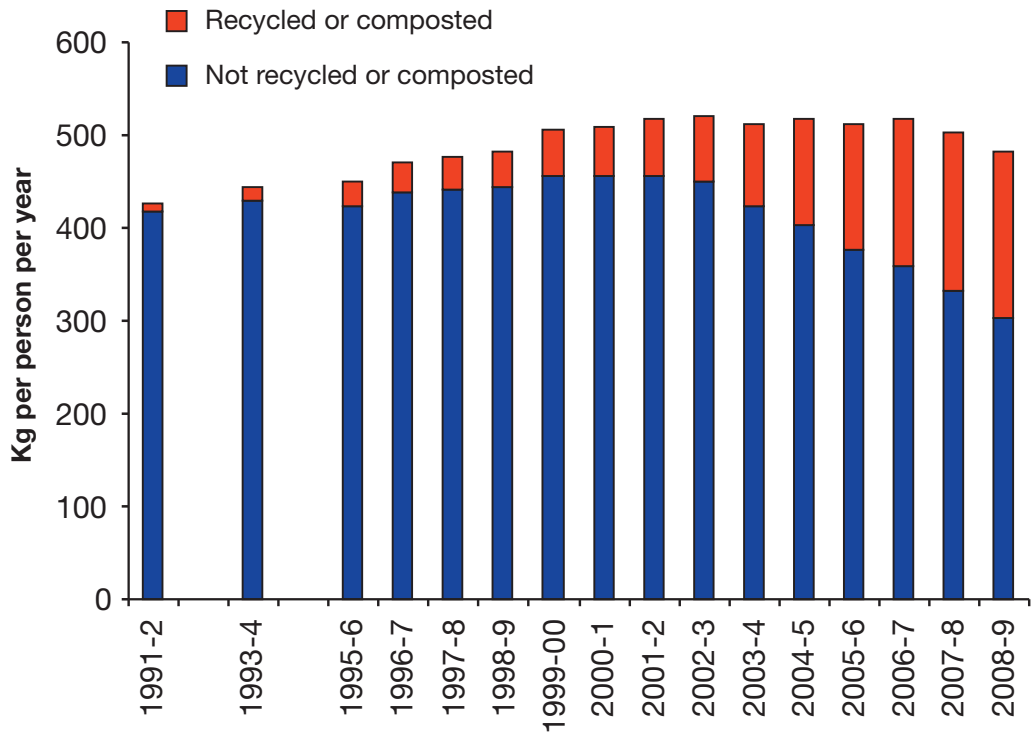
3.15 Figure 3-II shows the average amount of municipal household waste generated each year by each person in the UK, which in recent years has been roughly steady. Where the population has been rising, the total amount of waste may have been expected to increase. However, in Lincolnshire,

d The Stockholm Environment Institute used a technique called structural decomposition analysis (SDA) to determine how changes in different components of population, affluence and technology have driven emission changes between 1992 and 2004.

for example, we heard in March 2010 that although the waste strategy had assumed an annual 1.5–2.5% increase in waste arisings to take account of growth in the number of households and increasing consumption, there had in fact been a reduction of 4% over the previous year, possibly as a result of the economic downturn and consequent reduction in commercial waste.[8]

3.16 Each country of the UK has seen a significant increase in the proportion of waste being recycled or composted. As a result of this, and of the development of waste management infrastructure and of markets for recycled material, residual household waste in England, for example, decreased by 22% per person between 2000 and 2006,[9] contributing to the one fifth reduction in total waste to landfill, despite the significant growth in population. To the extent that the main environmental impact is determined by the amount going to landfill (which we realise is a gross simplification), 'technology', in terms of recycling and composting, has been more significant than 'P' and 'A'.

FIGURE 3-II
Household waste generated per person in the UK, 1991/92 to 2008/09[11]



3.17 The Department for Environment, Food and Rural Affairs (Defra) had a target to reduce total residual household waste in England from over 22.2 million tonnes in 2000, to 15.8 million tonnes in 2010, and an aspiration to reduce it further to 12.2 million tonnes in 2020 – a reduction of 45%.[12,e] The Scottish Government, in its recent '*Zero Waste Plan*', set the ambitious target of recycling and composting 70% of all waste by 2025 (i.e. not just municipal waste but commercial and industrial also).[13] An example from Scotland is described in Box 3B. The Welsh Assembly Government, too, issued a consultation in June 2010 which proposes a target for councils to recycle or compost 58% of municipal waste in 2015/16 and 70% in 2024/25;[14] and the Northern Ireland Waste Management Strategy 2006-20 sets a target of 45% for the recycling and composting of household wastes by 2020.[15]

e This was a target set by the previous administration, and is therefore not necessarily that of the current Government.

BOX 3B WASTE MANAGEMENT IN THE HIGHLANDS

The Highland Council indicated that projected demographic changes are not thought to have major consequences in the Highland area in relation to waste management. It considered that additional waste arisings from future population growth can be accommodated within current structures and that the impacts will be diluted due to the fact that growth will be spread across a wide area. Certainly, an increasing desire to recover material from household waste will require further provision of recycling facilities, which are accessible from even remote parts of the UK. Other demographic factors have been proposed as having an impact on the types and quantities of waste generated. Referring to waste analyses carried out in the Highlands and in Scotland as a whole, the Highland Council told the Commission that age and household composition were not considered to have a significant effect on waste arisings, but noted that the type and quantity of waste produced might alter with a changing age structure.[16]

3.18 Defra explained that while demographic change can influence waste arisings, other macro and behavioural drivers influence arisings to a greater extent.[17] For example, public attitudes and consumption practices can determine how much of a product is wasted, and changes in economic growth can influence the purchasing of products and, therefore, the amount and type of waste produced. Moreover, the link between consumption and waste generation is a complicated one, since, in terms of a 'product life cycle', waste is generated in the extraction, exploitation and production phases and not just in the consumption of the final product. Much of the 'waste' associated with consumption may in fact occur in other countries where primary production takes place. Equally, some recycled waste is sent overseas for processing, and this too can have environmental implications.

THE WATER CYCLE

3.19 There are significant pressures on water resources in the UK which affect both water supply and the quality of the aquatic environment (including groundwater, rivers, lakes and coastal waters). Pressures are greatest in the south-east and eastern England due to the combination of relatively low rainfall and highest population density and water use per household.[18] Population growth and associated changes in related demographic factors will add to the challenge of providing integrated water and wastewater services whilst meeting extensive environmental standards. Planning investment to anticipate growth must incorporate targets and restrictions set by economic regulators, such as Ofwat, and environmental regulators, such as the Environment Agency (and the equivalent bodies for each part of the UK).

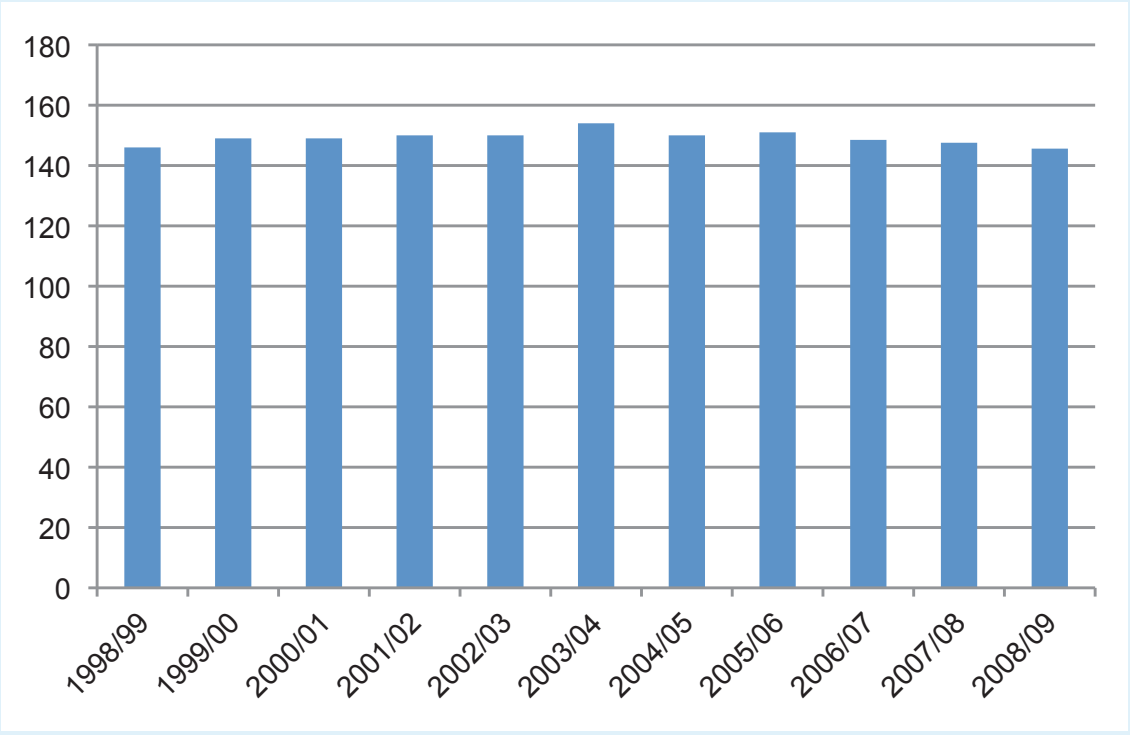
3.20 In England and Wales, the framework for regulation has evolved to incorporate the long-term perspective – the five-year price structure is now determined within the context of 25-year Strategic Direction Statements and Water Resources Management Plans.[18] Since 2009, planning and service delivery now also take place within the context of the River Basin Management Plans prepared in six-year cycles under the Water Framework Directive.[19]

Water resources and supply

3.21 In England and Wales, annual individual water consumption averages 148 litres per day – a slight decline in consumption over the last five years, as illustrated in Figure 3-III.[20] In 2008 average consumption by each individual at home ranged from 107 litres per person per day to 176 litres per person per day for different water companies. The south-east of England, for instance, is the most water stressed and is also the area where companies have reported the highest water use per person.[21] We received evidence that the causes of variation were factors such as affluence,

household occupancy (see Table 3.1) and whether the property is metered.[22] The Environment Agency has predicted that by 2020, the total demand for water could rise by 5% or 800 million litres a day, driven by a growth in population and an associated increase in the demand for food and other goods and services.[23]

FIGURE 3-III
Average per capita household water use (in litres) in England and Wales, 1998/99 to 2008/09[24]



3.22 The Environment Agency has described a set of possible futures for water use in the 2050s using four scenarios.[25] The scenarios produce a range of predictions – from a 10% decrease to a 35% increase in water use by 2050. The 'envelope of demand' provides an important framework for assessing plans to manage long-term trends arising from economic development, population growth and climate change. These scenarios illustrate the role of different variables in the IPAT formula. The lowest demands for water ('I') are predicated on a small population increase ('P'), lower personal consumption ('A'), and increased investment in new technology ('T') to facilitate reductions in per capita consumption and overall demand (for example, by better leakage management).

3.23 Water resource planning is necessarily long term. Water resources need to be balanced both by reducing demand, by controlling leakage and by seeking to influence consumers' consumption, and also by increasing supply through developing new sources. The Environment Agency noted that people who have a water meter generally use 10-15% less water than those who do not.[26] (Domestic water consumption however represents only about a quarter of total water demand, taking account both of public supplies and water abstracted for other uses.[27]) Others observed that water consumption varied by house type and size; for example, Bristol Water found that there were differences in levels of consumption in new housing compared to older housing, and that housing type and size was a more significant driver for water consumption than income group in the existing housing stock.[28] Reducing leakage is also a key objective. Since 1995, water companies have reduced leakage by around 30% and there is scope for further improvement.[29] Defra's aim

is to reduce individual water use in England and it is "confident that with today's technology for metering, tariffs and water efficiency that per capita consumption of water can be reduced, through cost effective measures, to an average of 130 litres per day by 2030".[30] As Figure 3-III illustrates, there has been limited progress towards this over the last few years.

3.24 New sources could include new reservoirs, more recycling, the exploitation of saline waters, or the harvesting of rainwater and surface water for non-domestic uses. All these require investment in new technologies, such as the desalination plant built by Thames Water to help meet peak demand (see 4.14). Additional demand for water resources will also mean extra investment in the distribution system. Not only do new properties need new pipes, but the mains network infrastructure often has to be upgraded to cope with pressure and continuity problems. The water companies' Water Resources Management Plans incorporate a range of actions which vary on a regional basis to cope with the projected demand up to and beyond the 25-year period.

Water quality

3.25 Meeting demand for water is one challenge. Maintaining water quality is another, and increases in the amount of wastewater as the population grows (an increase in 'P') can mean not just treating more sewage to normal standards, but can often trigger requirements for treatment to more demanding standards (that is, a reduction in the 'T' factor) if environmental standards are to be maintained. The basic principles are now defined in the Urban Wastewater Treatment Directive,[31] with the addition of the facility to regulate the presence of nutrients such as phosphorus and nitrogen. Conditions in the UK often mean that other criteria also now apply, such as ammonia and nitrate limits (usually determined by other EU Directives, such as those for shellfisheries, fisheries and bathing waters).

3.26 Environmental objectives have played an important role in targeting a major clean-up campaign of industrial discharges and sewage treatment works over the last 20 years. A 'General Quality Assessment (GQA) Scheme' has been operated across the UK (with some variations in the Devolved Administrations) to monitor river water quality in terms of biology, nutrients (nitrates and phosphates) and chemicals.[32] The GQA scheme was largely focused on the impacts of water industry discharges and the results indicate significant improvements between 1990 and 2008. In England, the percentage of rivers in the 'Good' or better category rose from 55% to around 75% over this period. In Scotland and Wales, nearly 90% of rivers were assessed as 'Good' quality or better in 2007.[33] This demonstrates that it has been possible to improve environmental quality at a time when the population has been increasing, though this has been expensive as a considerable amount has been invested in better technology, but a minority of rivers still fail to achieve good status.

3.27 The rising cost of water treatment is an important environmental constraint and the Commission received evidence that there are places in the south-east where these constraints are becoming significant.[34] We return to this in the next chapter.

Greenhouse gas and carbon emissions from households and other sources

3.28 Identifying the impact of the growing population in the UK on greenhouse gas emissions is complex. Changes are associated with every element of the IPAT formula, as Figure 3-I illustrated. The Energy Saving Trust (EST) told us that the factors having a negative impact include falling average household occupancy, increased use of appliances and consumer electronics, greater affluence, longer life expectancy and heating homes to a higher temperature. Factors having a positive impact include the use of energy sources other than fossil fuels, improved building

standards, energy efficiency programmes, rising fuel prices and greater awareness of energy efficiency, as well as campaigns run by bodies such as the EST.[35] Agriculture and food production also contribute significantly to greenhouse gas emissions.[36]

3.29 At the global level, analysis has shown there are clear links between population size and greenhouse gas emissions, though the relationship is not always simple.[37] The evidence suggests that emissions per person depend on income, technology, demographic factors like household size, city size and population density in built-up areas, institutional and economic factors like the availability of public transport at reasonable cost and convenience, and a host of behavioural factors like people's propensity to walk, bike, share a car, or drive solo to work. For example, the carbon dioxide (CO_2) per person emitted by passenger transport is lower in more densely populated cities.[38]

3.30 Figure 3-IV shows a decreasing trend in direct greenhouse gas and CO_2 emissions from UK sources. However, from a wider, global perspective, emissions associated with consumption in the UK (that is, taking account of the emissions associated with imported goods, minus those associated with exports) are rising, at least for CO_2, as shown in Figure 3-V. While we do not have directly relevant data on the extent to which the UK has 'exported' some of its carbon emissions by increasingly sourcing its carbon-intensive products from overseas (especially China), a number of studies have shown that a high proportion of China's own carbon emissions are accounted for by its net exports. In 2004, for example, some 23% of China's total CO_2 emissions were accounted for by its net exports, a level of emissions roughly double the UK's total CO_2 emissions in that year.[39]

FIGURE 3-IV
Greenhouse gas emissions and carbon dioxide emissions from UK sources between 1990 and 2008[40]

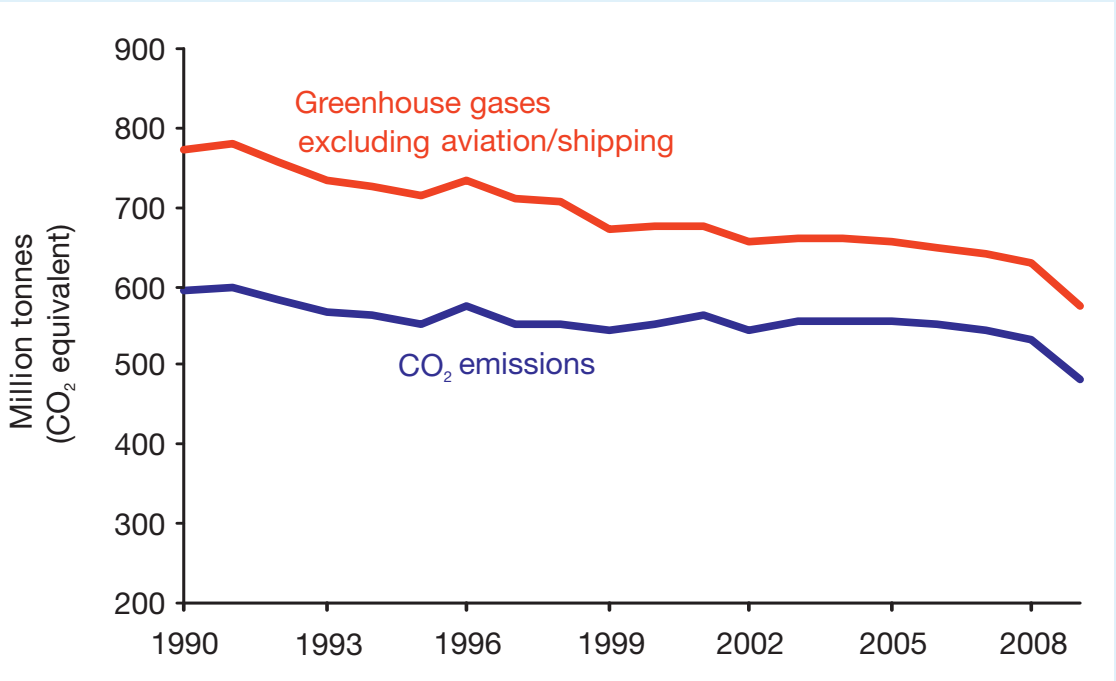
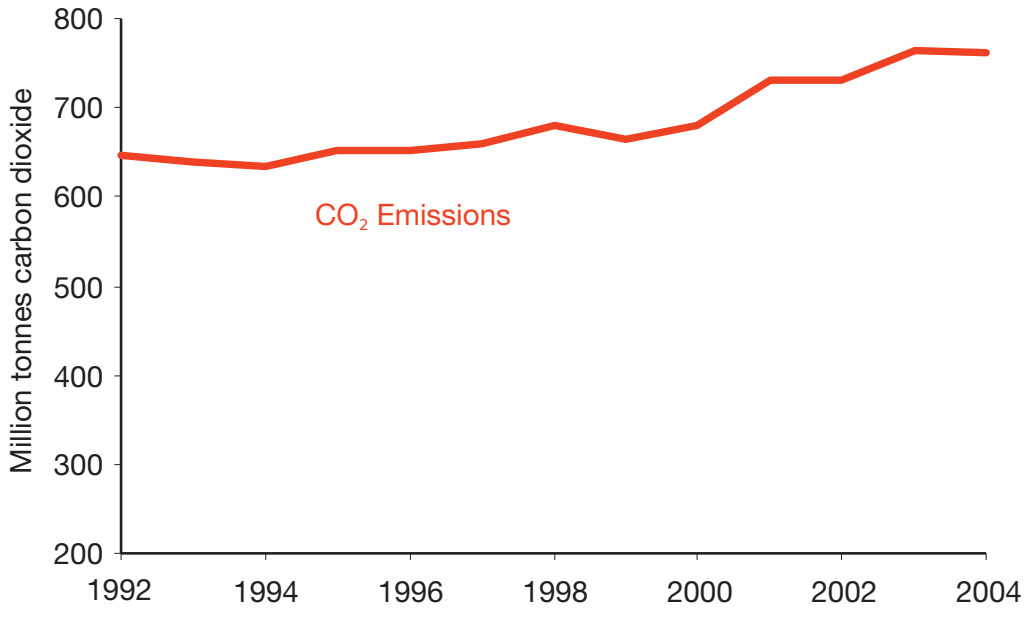


FIGURE 3-V
Carbon dioxide emissions associated with UK consumption (including emission overseas)[41]



3.31 The Government aims to achieve ambitious levels of decoupling of economic activity and CO_2 emissions in the future. The statutory target of an absolute cut in greenhouse gas emissions by 80% by 2050, compared with 1990, implies that the carbon intensity of an average unit of output would be less than one tenth of the 1990 level.[42] This demonstrates the enormous scale of the challenge, and clearly an increase in the population will make it more difficult to achieve.[43] The Committee on Climate Change has set out in its reports the measures which will be necessary to reduce greenhouse gas emissions. These include: improvements to the energy efficiency of buildings; decarbonising the power sector (replacing existing conventional fossil fuel plants with renewable technologies, nuclear new-build and carbon capture and storage); reducing the impact of transport (through improving the fuel efficiency of conventional engines and increasing the use of sustainable first generation biofuels, with the progressive introduction of new technologies such as electric cars, plug-in hybrids and hydrogen vehicles, and second generation biofuels); reducing the impact of the heat sector (through increased use of biomass in boilers and combined heat and power, air exchange and ground source heat pumps, and modern electric storage heating); and reducing the impact of industry (through the introduction of new technologies).[44] The Committee on Climate Change concluded that while it will be challenging, it will be feasible to meet the 80% reduction target.

Air quality

3.32 Growth in population can affect air quality through increased emissions from transport (particularly particles, nitrogen oxides and carbon monoxide), electricity generation using fossil fuels (particularly sulphur dioxide, particles and nitrogen oxides), industry (particles, sulphur dioxide, volatile organic compounds (VOCs) and nitrogen oxides) and food production (particularly ammonia, nitrogen oxides and methane). Reactions in the atmosphere can produce a number of secondary pollutants, particularly the photochemical oxidant gas ozone. Over the last 40 years, population growth coupled with increased mobility and consumption of energy and consumer goods have all contributed to drive up emissions. Air pollutants are of concern owing to their

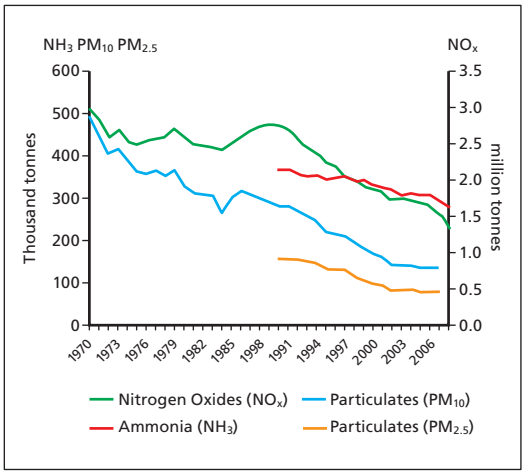
effects on human health (for example, they can exacerbate respiratory diseases or cause acute coronary syndrome), agriculture (through reduced crop production) and the natural environment (through bioaccumulation, eutrophication or acidification).

3.33 However, environmental legislation introduced over the past 50 years in the UK and by the EU has provided a strong impetus to reduce the emissions of harmful pollutants from all these sources, primarily by technological innovation.[45] Initially there was a shift in the dominant sources of air pollutants from mainly industry and domestic heating to transport and power generation. More recently, the main reductions in emissions have resulted from changes in the fuel mix in energy generation (from coal to gas and renewables), introduction of emission control technologies (particularly desulphurisation of power stations and catalytic convertors for cars to control the VOCs that contribute to the formation of ozone). Greater energy efficiency in the manufacturing sector and changes in production processes have also contributed, as well as changes in the UK's industrial base. As a consequence, there has been a significant reduction in the UK emissions of particles (in mass terms), lead, sulphur dioxide, nitrogen oxides, heavy metals and persistent organic pollutants such as polychlorinated biphenyls (PCBs) and dioxins. There has also been a reduction in both the frequency and size of 'ozone events' as sources of ozone precursors have been brought under control, although the transatlantic transport of ozone is making an increasing contribution to background mean concentrations in Europe.[46] Figure 3-VI shows the changes in UK emissions, and in pollution levels in one city, for some key pollutants.

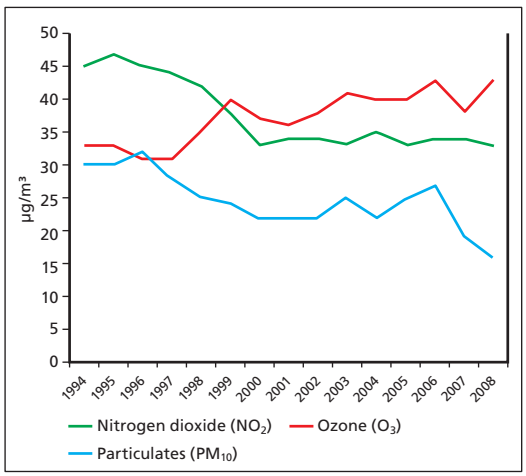
3.34 In urban areas, the main challenge is to reduce the number of places where limits for nitrogen dioxide (NO_2) and PM_{10} (i.e. particles of less than ten microns in aerodynamic diameter) are at times exceeded owing primarily to emissions from vehicles. This can be attempted through a range of measures including the introduction of congestion zones and pedestrianisation. The 2008 national assessment of the UK showed that all areas of the UK except central London were in compliance with the PM_{10} limits.[47] However, the UK has a number of mainly urban locations which regularly exceed the UK limit values for NO_2 and which will continue to do so beyond 2015 without further action to control emissions.

FIGURE 3-VI
Emission trends for key pollutants, 1970-2008, for the UK and annual mean concentrations at Birmingham centre, 1994-2008[48]

Emission trends of key pollutants (total UK)



Annual mean concentrations of Birmingham Centre (AURN Station)



3.35 The 2008 EU Air Quality Directive set targets for further improvements in PM_{10} and NO_2 levels and introduced new targets for the control of fine ($PM_{2.5}$) particulates.[49] This legislation is aimed at reducing the number of early deaths from urban air pollution that were estimated at more than 20,000 each year by the Committee on the Medical Effects of Air Pollution (COMEAP) in 1997[50] and have been the subject of much debate since.[51] The UK Government and the Devolved Administrations published an Air Quality Strategy (AQS) in 2007.[52] Local authorities are required to implement the AQS and must take action when objectives cannot be met by specific dates.

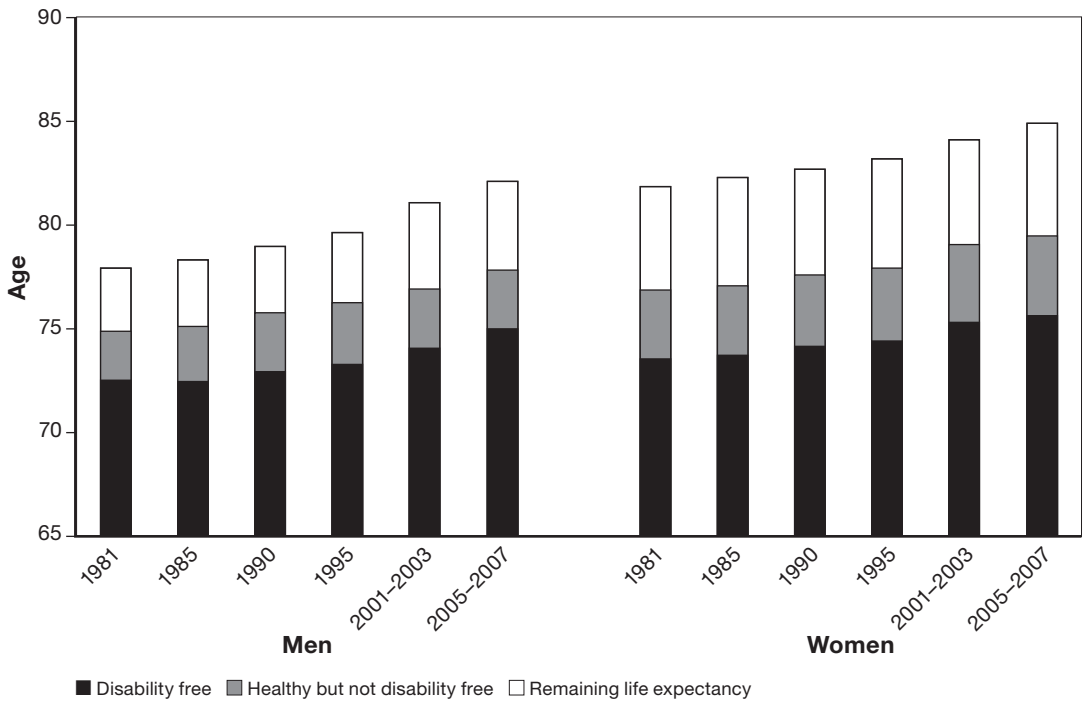
3.36 Management of air quality is a devolved responsibility and there are indications that the approaches of the different countries are beginning to diverge. For example, the Scottish Government has set more stringent objectives to control fine particulate matter in urban areas, as baseline levels in Scotland are largely lower than concentrations in England. The current objective[53] for PM_{10} is an annual mean of 18 μgm^{-3}, but the Scottish Government intends to set a lower limit for $PM_{2.5}$ of 12μgm^{-3} by 2020. The House of Commons Environmental Audit Committee recently concluded that the costs of urban air pollution in the UK had been underestimated, although their conclusions are open to much debate.[54] It said that current issues will not be resolved without a significant shift in transport policy and greater action by local authorities to implement local air quality strategies.

3.37 In summary, changes in affluence ('A'), resulting in increased mobility (with the potential for an ageing population to use vehicles more frequently as a result) and consumption, have the potential to drive up the emissions of air pollutants. Population growth in areas with poor urban air quality will contribute to further deterioration without mitigation measures. But in these areas, those most exposed to poor air quality are actually less likely to own their own vehicle, and hence do not contribute to the problem but suffer the effects of the behaviour of others. This was highlighted in the European Commission's communication on a European Environment and Health Strategy in 2003.[55] Such exposures may increase the risk of developing cardiopulmonary disease and thus the creation of later generations of people with more years of ill health. Advances in emission control technology and energy/fuel efficiency ('T') have made significant improvements in air quality possible, and further improvements may come from the transition to a low carbon economy.

Increasing lifespans

3.38 In Chapter 2, we noted that people are living longer and that the number of older people is rising, particularly in the over 85 age group (as highlighted in Figure 2-IV in Chapter 2). Figure 3-VII shows the current life expectancy of a man or woman aged 65, and how this has increased over the last 20 years. These trends are likely to continue. It is therefore important to consider where increasing lifespans and changing age structures are likely to have implications, through patterns of lifestyle and consumption, for the environmental impact of the population, and whether there are particular features of the lifestyles of older people which are relevant.

FIGURE 3-VII
Expected life beyond age 65, disability free and/or in good health, Great Britain[56]



Differential patterns of consumption by age

3.39 Data from the Stockholm Environment Institute, presented in Figures 3-VIII and 3-IX, show how carbon footprints can differ according to age. These data present general patterns of consumption and mask the high levels of variation within each age group. On average, however, 50-64 year olds have the highest 'carbon footprint' of any age group due to high levels of consumption of carbon-intensive goods and services. The extent to which older people's carbon footprint relates to the use of energy in the home is also particularly striking. The growing number of people aged 75 and over, combined with their sensitivity to lower temperatures and demand for heat, suggests that improving the energy efficiency of the housing stock for older age groups should be a priority.

3.40 As people live longer, and are healthy for longer, it is possible that the consumption patterns currently associated with the 50-64 age group, for example, may be reflected in the lifestyles of many of those in the 65-74 group – though this will also depend on whether they have the resources to maintain a lifestyle with similar levels of travel and consumption. There is also an argument that 'cohort' lifestyles may be more of an influence than age – for example, the higher levels of consumption widely adopted by the generation of post-war 'baby boomers' may not be repeated by subsequent generations who may not enjoy the same average level of wealth.

FIGURE 3-VIII
Age-related carbon footprint, UK, 2006[57]

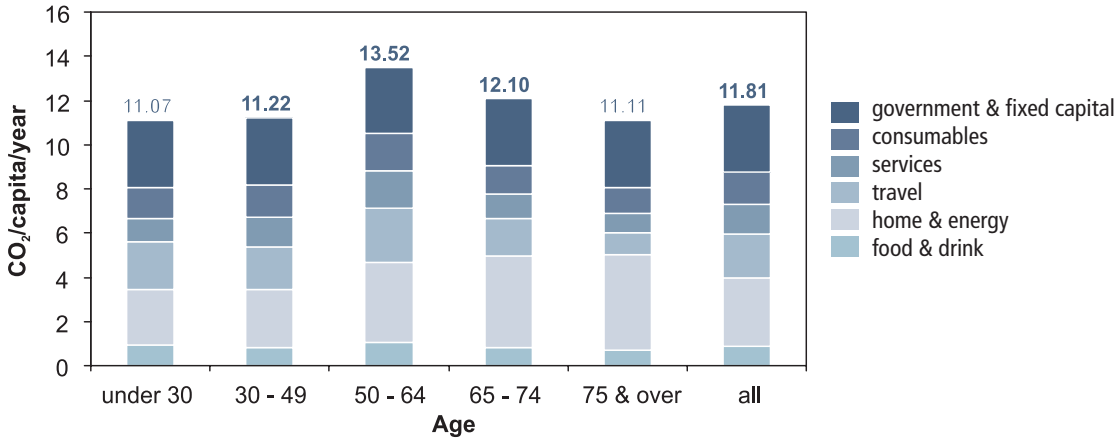
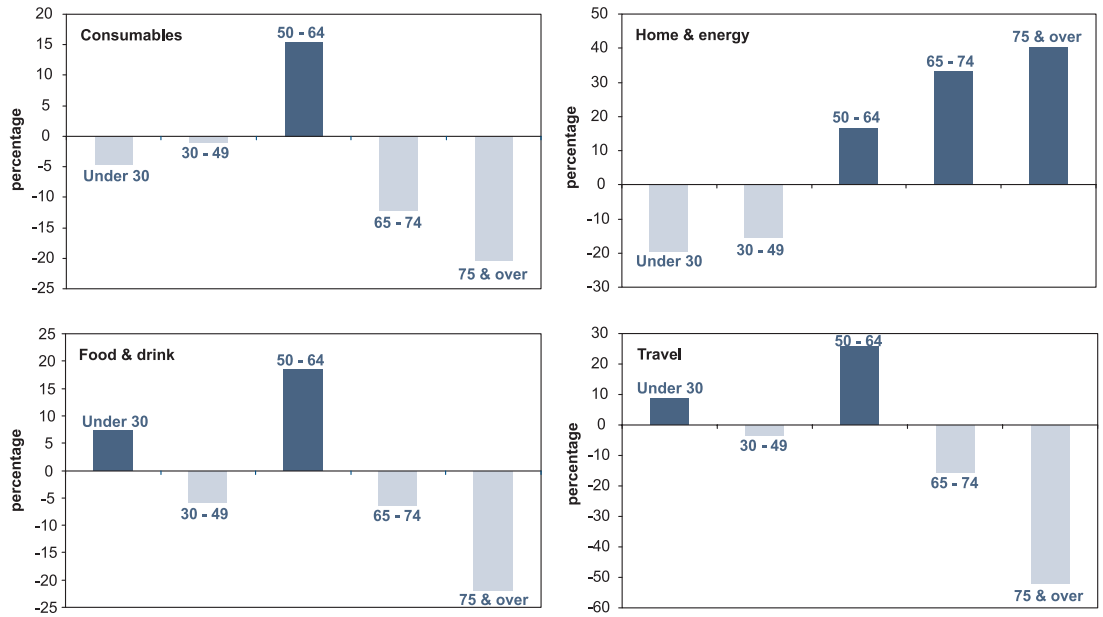


FIGURE 3-IX
Percentage difference in carbon dioxide emissions by age and category compared to the average UK carbon footprint, 2006[58]



Ageing, disease and demographic change

3.41 As people age, their risk of developing chronic disease increases and with this comes an increased risk of ill health. Health is a key factor influencing older people's lifestyles, their impact on society and the environment, and how much support they require, although information on the environmental impact arising from these changing patterns of lifestyle in older people is limited. In terms of planning for the future, of particular importance is knowing what proportion of these extra years will be years of active, healthy life and what proportion will be affected by illness. However,

whatever these proportions may be, the corollary of an ageing population is an increased use of medical services, pharmaceuticals and, potentially, care home services (and a demand for greater mobility for caring professionals, particularly in rural areas).

3.42 In many cases, however, advances in medical science and healthier lifestyles will push back the onset of conditions such as cardiovascular disease or diabetes, so that, in principle, people will be able to enjoy more years of active life not compromised by illness, as illustrated by the increasing healthy life expectancy for both men and women in Figure 3-VII. It is not clear, however, what environmental implications may flow from this.

Health miles

3.43 During our visit to the Highlands and Islands we were struck by the amount of travelling undertaken by people in more remote areas of the UK in order to access health care. For example, we were told that up to 30% of all journeys on flights between the Western Isles and the mainland are for health purposes. Travelling to access medical care was described to us in the form of 'health miles' – the mileage covered to maintain health.[59,f] The economic costs of travelling for health reasons are well understood by health economists but the environmental impact less so.

3.44 As is common in other countries with low and sparse population densities, there have been attempts to reduce travel associated with delivering health care, particularly in more remote communities, through the use of video-conferencing and telephone or online consultations. These techniques have received mixed responses but over time we believe it is likely that they will have some effect on reducing health mileage. However, this is a poorly quantified impact and one which should be amenable to measurement and intervention.

Pharmaceutical products in the environment

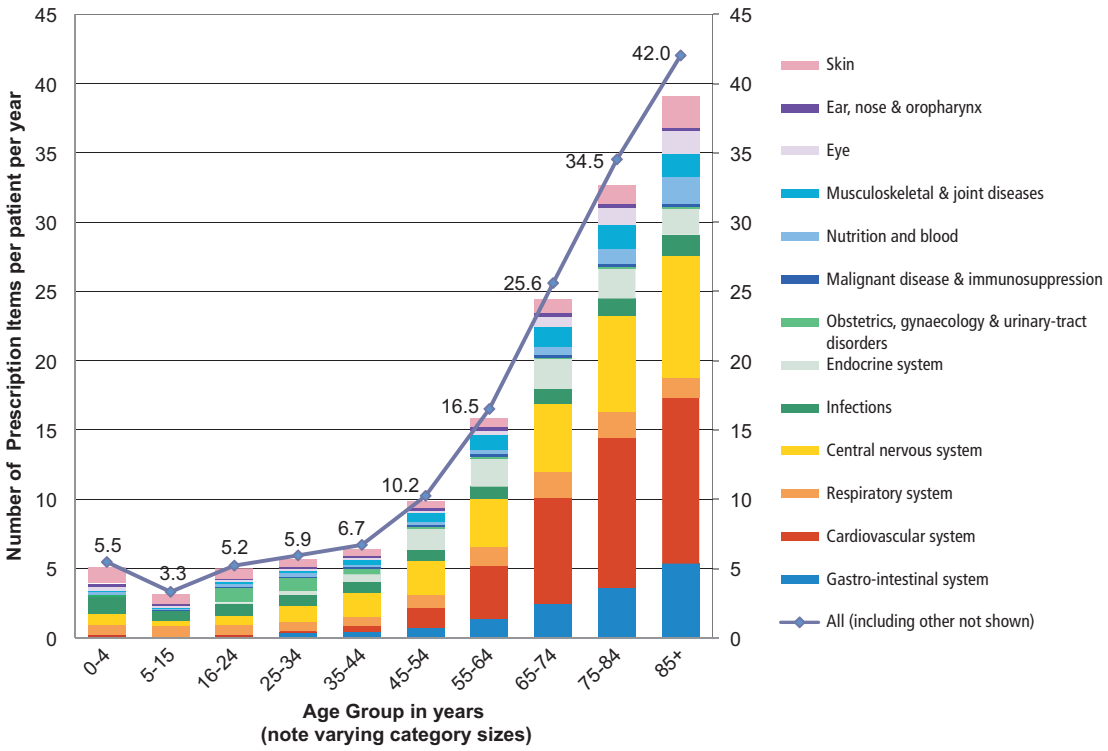
3.45 The use of pharmaceuticals is greater in older people because of the greater prevalence of disease and the greater likelihood of more than one condition being present. Most of these drugs are administered at home and either the unchanged drug or its metabolites are excreted via urine or faeces into sewers, some finding their way into the environment. Additionally, products can reach the environment during the manufacturing process and through disposal of unused medicines. Figure 3-X shows annual prescribing rates for women according to age.[60] (The data for men are broadly similar and are available on the RCEP website.)

3.46 The impact of many kinds of excreted pharmaceuticals on the environment is currently uncertain.[g] Concentrations, where monitored, are generally very low and there is debate about whether these small concentrations are likely to be too low to cause negative ecosystem effects, or whether we should take a precautionary approach in reducing exposure while effects are uncertain. But an analysis of current prescribing practices in the UK for older patients for cardiovascular medicines based on ONS population projections suggests that volumes of medicines used could double by 2052,[61] prompting us to consider whether the environmental impacts of pharmaceutical products should be of greater concern to manufacturers, researchers and regulators. The Advisory Committee on Hazardous Substances is considering this issue.

f Arguably, this might also include journeys taken to enhance health, for example, trips to the gym or to other outdoor activities.

g However, much is known about the effects of endocrine disruptors, particularly those used in the contraceptive pill.

FIGURE 3-X
Annual prescribing rates by therapeutic group, females, England and Wales, 1998[62]



Care home use

3.47 With increasing disability comes a need for more care support and there is a move towards more care homes and also more imaginative retirement care such as retirement villages. Whilst these developments might lead to a reduction in environmental impact on the basis of economies of scale (reductions in single-occupancy houses) we have seen no detailed analysis of the issues. We consider that this is an important area where knowledge is poor and measurement of these various influences will be required to inform future planning.

The effects of household structure

3.48 It is widely assumed that, as a general rule, smaller household size is likely to lead to higher energy use and CO_2 emissions per head, and the Commission therefore sought further evidence on this point. Table 3.1 draws on data collected as part of the integrated impact assessment of the London Housing Strategy[63] and illustrates how, on average, resource use varies according to the size of household. The table shows that large households consume proportionately fewer resources than smaller ones, with the three-person household using overall only about twice (rather than three times) the water used in a one-person household. So household size is one of the factors which contributes, for example to the variations in the amount of water consumed per head, as noted in 3.21. Electricity use, gas use and waste generation show quantitatively similar trends. The same pattern has been found in other countries. For households in the United States in 1993–94, for

example, two-person households used about 17% less combined energy (a sum of residential energy and transport energy) per person than did one-person households, and three-person households used more than a third less energy per person than did one-person households.[64]

TABLE 3.1
Effect of household size on resource use, London[65]

Number of people in the household	Comparative resource use and waste generation per household where 1.0 represents consumption/generation per capita of a one-person household.			
	Water use	Waste generation	Electricity use	Gas use
1	1.0	1.0	1.0	1.0
2	1.6	1.9	1.4	1.3
3	2.1	2.4	1.6	1.4
4	2.6	2.5	1.8	1.6
5	3.1	2.7	1.9	1.7
6	3.7	2.8	–	–

3.49 However, these average figures overlook very wide variations in resource use within each category of household size. Indeed, detailed work on the energy efficiency characteristics of houses shows that the variation between the energy costs per square metre of the most energy-efficient homes and the least efficient is, conservatively, a factor of four.[66] This suggests that there may be considerable scope for reducing energy consumption among those who currently use more than the average.

3.50 A number of water companies noted that, where they had monitored consumption (e.g. where meters had been installed or sample surveys conducted), per capita water use generally declined as household size increased, supporting the evidence in Table 3.1.[67]

Spatial distribution

3.51 In Chapter 2 we noted that demographic trends play out in different ways in different parts of the UK, with different environmental impacts as a result. During our study we saw some examples which illustrate this; three such examples related to issues covered in this chapter are set out in Box 3C. This spatial variation in demographic trends and in environmental circumstances is crucially important, and is the subject of the next chapter.

BOX 3C EXAMPLES OF SPATIAL VARIATION

The Commission saw a number of examples which illustrate how environmental impacts differ significantly from place to place reflecting local circumstances, highlighting some of the complexities and subtleties of the IPAT formula.

- In Lincolnshire, seasonal visitors (mainly holiday makers and day trippers) were less likely to recycle waste than residents, so proportionately more waste has been sent to landfill from certain areas and at certain times of the year.[68] There has been pressure on waste services where there have been sudden increases in inward migrant workers, and this had initially created some difficulties, but these had generally been overcome through the provision of additional bins to houses in multiple occupation and translation of guidance on recycling into the migrants' languages (a simple example of 'T').

- A study of York's carbon footprint[h] compared residents' CO_2 emissions area by area as a basis for devising an effective carbon reduction project.[69] The calculations appeared to show a considerable variation, ranging from 9 tonnes of CO_2 in one area to over 14 tonnes in others driven by variations in 'A' and 'T'. Generally, neighbourhoods with the highest carbon footprint tended to be in the city centre or rural and commuter areas, while those with the lowest footprint tended to be in the poor parts of the city or those areas with a high concentration of students. Housing and transport together made up 60% of the city's carbon footprint.
- Current water sources in the Inverness city region, which continues to experience significant growth in population ('P'), are likely to be overstretched and the water and sewerage service provider, Scottish Water, is currently evaluating potential new sources. Whilst the availability of water supplies is not of pressing concern, the treatment and distribution of potable water consume significant amounts of energy, as does the removal, pumping and treatment of wastewater, particularly in rural Scotland where the population is highly dispersed. Scottish Water is, in fact, the highest consumer of energy in Scotland ('I'). Increasing household demand for water supplies has, therefore, significant implications for the management of carbon emissions especially in less densely populated areas of the UK.

Affluence, consumption and behaviour

3.52 While this report is not about sustainable consumption, consumption patterns are a key driver of environmental impact. It is widely assumed that, on average, households with higher income levels will consume more and have a bigger 'environmental footprint' than those with less to spend.

3.53 This implies a direct link between economic growth and environmental damage, a recent example of which is provided by a 2009 study into the effect of different growth scenarios on consumption patterns and associated CO_2 emissions in the North East Region of England.[70] This suggested that consumer emissions in the North East could increase by between 15% and 19% over the period 2006–26 if the performance of the regional economy improved to meet the 'silver target'[i] which had been set out in the Regional Economic Strategy, noting that the additional transport associated with high economic growth would increase the percentage of household consumer emissions generated from housing, fuel and power by 11% (to 64%).[j]

3.54 Within these average figures, household emissions profiles varied significantly across the region, with those belonging to the most affluent Mosaic[k] group ('Symbols of Success')[l] generating emissions between 19% and 41% higher on a per household basis than any other group. The

h A carbon footprint is the total amount of CO_2 emissions which result directly and indirectly from the individual use of goods and services. It is measured in tonnes of CO_2 per person per year.

i The silver target would see the North East Region reaching 90% of UK average Gross Value Added per head by 2016 and maintaining this share in the long term.

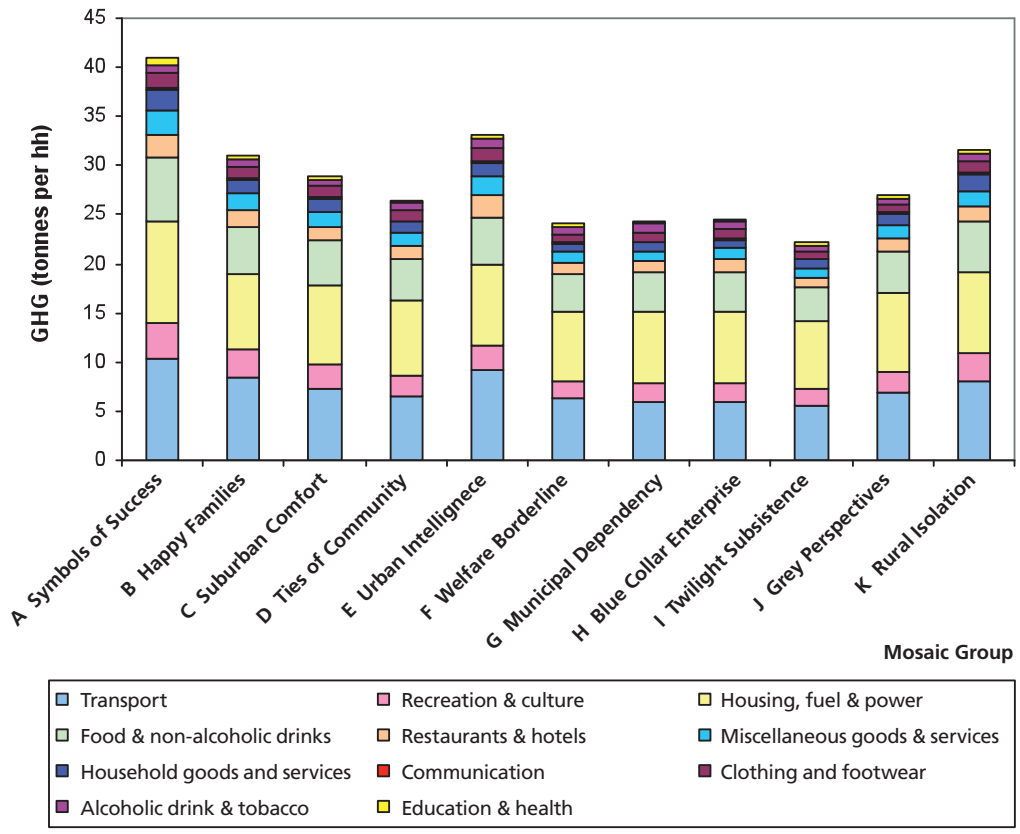
j We note however that growth in the North East may, at least in part, be the result of diverting to the region growth that would otherwise have occurred elsewhere in the UK, possibly in regions where the environmental impacts would have been higher.

k Mosaic is Experian's socio-demographic classification and segments all households in the UK into 61 types aggregated into 11 groups.

l The 'Symbols of Success' group includes people with rewarding careers who live in sought after locations and can afford luxuries and premium quality products.

Commission has not been able to study the underlying data used in the 2009 study but it does seem to suggest a substantial variation in annual household consumer emissions – particularly from transport – by Mosaic group, as illustrated in Figure 3-XI.

FIGURE 3-XI
Annual consumer emissions per Mosaic household in the North East for 2006[71]



3.55 Even this summary of the more detailed Mosaic analysis, which has to be treated with some caution as it necessarily makes assumptions about lifestyle and pattern of expenditure which might not always apply, underlines just how difficult it is to draw out any general lessons about the environmental impacts of demographic change. Many of the organisations and individuals who provided evidence did not collect or hold the data on which to base any conclusions about the consumption patterns of particular groups and hence of the relative contribution of each of the three drivers in the IPAT formula, for the UK as a whole, or for different parts of the UK.

3.56 The Commission also received evidence on migration and the impact that this can have on consumption levels.[72] There is rather limited information on the characteristics of those who leave the UK but, given that immigrants are usually relatively young and have lower incomes than the resident population, it is probable that the average income levels of emigrants will be higher than those of immigrants.

3.57 This appears to be borne out by an analysis of the environmental impact of those migrating into the UK which concludes that pressure on space and housing is less related to population growth through inward migration than it is to the trend towards smaller households and larger houses among the long-term resident population.[73] Given that there appears to be a connection between

income and environmental footprint (as explained in earlier paragraphs of this chapter, richer people tend to have higher levels of consumption of non-renewable resources, including higher levels of travel) it is quite possible that the lower average footprint of immigrants may be less than the higher footprint of those who have emigrated. It could be argued that this provides an example of a direct (and potentially positive) impact of demographic change on the UK environment. However, on a worldwide basis high levels of out-migration from the UK may lead to higher environmental impacts elsewhere.

The impact on biodiversity

3.58 The state of the UK's flora and fauna has been comprehensively summarised by Maclean.[74] There have been rapid losses of more than 50% in the last 25 years of once common species of animals such as hedgehogs, house sparrows and common toads, and extinction of many species in some areas. Plants have fared no better. On average, for example, one species of vascular plant was lost every two years from each English county during the 20th century; rates of loss were highest from southern and eastern counties where land use pressures are greatest. There have also been major declines (greater than 80%) in farmland birds since the 1960s. Butterflies have also suffered; 93% of habitat specialist butterflies and 76% of all butterflies have declined since the 1970s. Overall, across our best known groups, about a quarter of all species are at historically low levels or significantly threatened.

3.59 Moths illustrate particularly clearly the loss of species from those parts of the UK where demographic pressures are greatest. Rothamsted Research has conducted a systematic survey of UK moths using light-traps since 1964. The total abundance of moths declined by 44% between 1968 and 2002 south of a line roughly from York to Lancaster; there have been no significant declines in numbers north of that line. Over 20% of formerly common moths are now considered threatened using internationally recognised criteria.

3.60 At least in well-studied groups it is the 'habitat specialists' that have suffered most of the declines; generalists (less choosy, more adaptable) species are holding their own or increasing. Examples of groups with species that are habitat generalists which are increasing include moths (about 70 of some 337) and birds. Overall, more breeding bird species have increased than decreased in Britain over the last forty years: "Rarer species (those with fewer than 1000 individuals) have tended to fare better [a result of direct conservation action], whilst scarcer species (those with fewer than 100 000 individuals) are doing worse."[75]

3.61 These dramatic changes in UK biodiversity are driven by a number of processes, mostly (but not exclusively) the result of changes in land use, particularly in agriculture. The links to demographic change are not immediately obvious, but are spelled out in 3.63 below. The processes are habitat loss, habitat deterioration, the intensification of agriculture, commercial forestry and eutrophication (i.e. nutrient enrichment).[76]

3.62 Reductions in the human population (and the associated changes in land use) can also impact on biodiversity. In the Highlands and Islands, some of the traditional landscapes are dependent on careful management, and with people moving away from these areas, and reduced levels of management and intervention, landscapes and habitats will change. For example, in some parts of Scotland, if grazing of some of the mountain moors declines, they may begin to afforest, returning to the state prevailing before they were cleared. This would be a different kind of ecosystem, but it is a matter of judgement, rather than science, as to whether it would be a positive or negative

change. In the case of the Hebridean Islands, the machair habitat is one of the rarest in Europe and is important to the conservation of rare plants and flowers, as well as endangered species of birds, such as the corncrake.[m] The desire to maintain the current landscapes and the management practices which sustain these species is one of the factors behind the policy of seeking to sustain the population in these remote areas.

3.63 All three elements of the IPAT formula are involved in the loss of biodiversity in the UK, but the linkages are often indirect. For instance, agricultural intensification allows more people to be fed ('P') so the impacts appear through 'T' ('high-technology' farming) and 'A' (consumer choices about what, and how much, we eat). Of course, 'ethical consumers' can try to make choices that benefit the environment, but the overall impacts across the whole population are largely negative. As summarised in the previous paragraph, declining human populations can also lead to habitat degradation, although negative impacts can possibly be mitigated by changes in the way habitats are managed, by introducing mowing regimes for example.

3.64 It is not just agriculture which drives the loss of biodiversity in the UK. More people and more households mean more roads, more cars and more journeys, and more infrastructure in general, all of which ultimately contribute to the loss of biodiversity. The pathways are often long and not immediately obvious, but the negative impacts on wild plants and animals are nevertheless real and very significant.

Summary

3.65 The IPAT formula provides a helpful framework for thinking about the environmental impact of the UK population, and focusing on the three key elements which determine that impact – the size of the population (together with other demographic characteristics such as the age profile and the number of households), the affluence of the population (reflected in lifestyles and patterns of consumption), and the influence of technology (which in some cases may reflect tighter regulatory standards). In practice the situation is often more complex than can be represented by a simple equation, with many factors in play which mean that there is no simple, linear relationship between the environmental impact and any one of the three factors, and the factors themselves are inter-related. Moreover, the relative importance of the different factors will vary from place to place.

3.66 It is clear, however, that while an increase in the population of the UK has added to the environmental impact, in practice changes in the other two factors – 'affluence' and 'technology' – have been of far greater importance. This is an important conclusion, for two reasons. As we have said (3.9), it would be wrong to focus on any one component of the formula alone – there is no 'optimum' population – but rather the impact of all three factors needs to be addressed. Second, the three factors are susceptible to different degrees to influence by Government intervention – the focus of any policies aimed at 'managing' the environmental impact of the population need to take this into account. We return to this issue in Chapter 6.

m Machair refers to a fertile low-lying grassy plain found on some of the north-west coastlines of Scotland, in particular the Outer Hebrides. Two distinct types exist: a sand-dune pasture subject to agricultural cultivation, which prevails in wet and windy conditions; and the land between a beach and the area where sand encroaches on peat bogs further inland.

Chapter 4

Demographic change and environmental constraints

4.1 We have noted in previous chapters that demographic trends do not apply uniformly across the UK and that the distribution, as well as the characteristics, of the population is crucial to its environmental impact: demographic change may have a more critical effect in places where the environment is already under pressure. As we have noted in Chapters 2 and 3 some places are facing the environmental and other challenges of accommodating a growing population. In contrast, other places are facing population decline, which has its own challenges including under used land and infrastructure, where population growth could have environmental and wider societal benefits. These communities can be within the same region or even within a few miles of each other. Understanding local circumstances is fundamentally important when discussing the environmental implications of demographic change.

4.2 The Commission received evidence suggesting that in many areas, demographic change, which drives the need for housing and associated infrastructure, undoubtedly puts pressure on environmental resources such as water quality and availability, air quality and space for development (including waste disposal facilities). Indeed, in some cases it may be difficult, or costly, to accommodate development while maintaining these environmental resources in an acceptable state – in other words, there are environmental constraints. We begin this chapter with a summary of the examples we encountered of these potential environmental constraints. In the second part of this chapter we discuss the nature of environmental constraints in more detail, focusing on law and policy, and draw a distinction between *environmental limits* and *environmental constraints*.

Examples of potential environmental constraints

4.3 In this section we look at environmental constraints (actual, perceived or potential) to population and household growth. Many of the examples come from south-east England (where pressures on the environment are greatest), but we also consider other parts of the UK. We have particularly looked at housing, water quality and quantity, air quality, biodiversity and landscape, and waste.

The South East of England

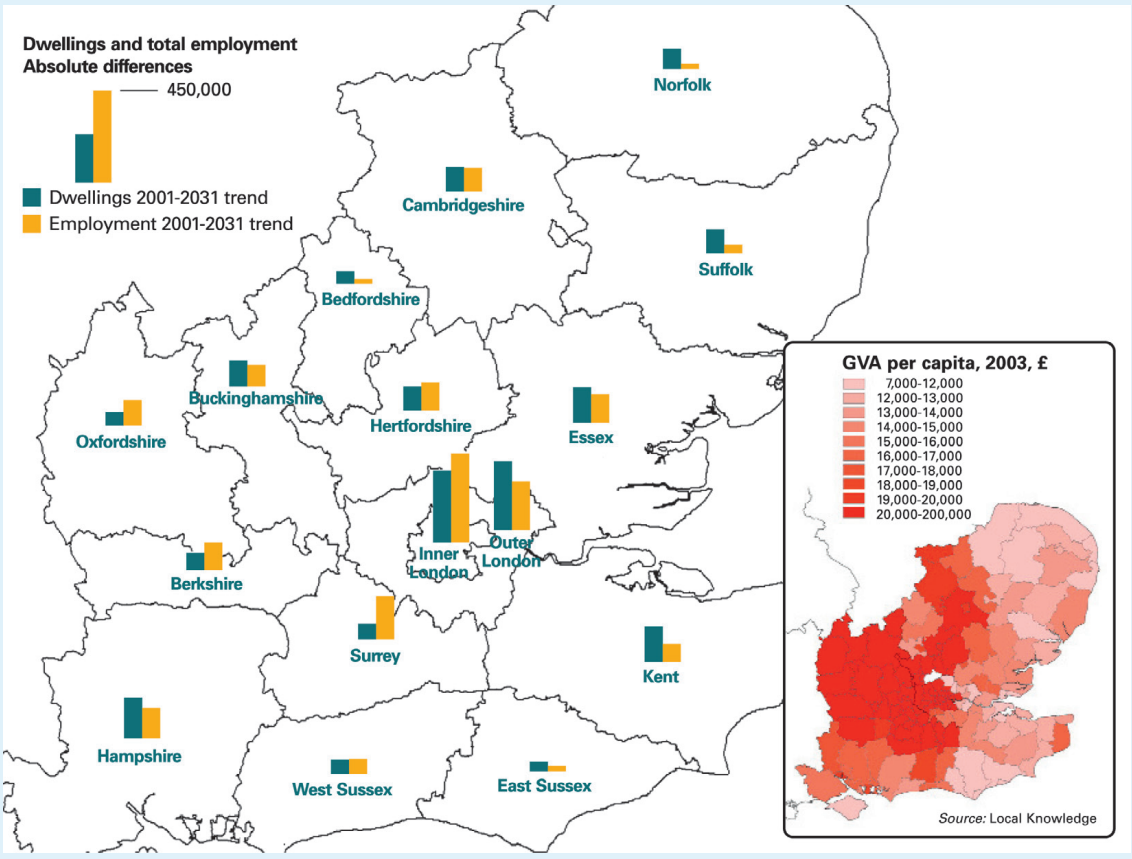
4.4 The conclusion of the sustainability appraisal of the final Regional Spatial Strategy[a] for the South East of England included the comment that "Of all the English regions, the South East is under the greatest pressure to provide more homes."[1] In a fairly stark tone it goes on to note that many aspects of the environment in the South East Region are already under significant pressure, despite the fact that efforts have been made to minimise this pressure. It pointed particularly to pressures on water resources throughout much of the region; water quality in the Solent area, and possibly elsewhere due to constraints on wastewater treatment; pressures on air quality near the

a The Planning and Compulsory Purchase Act 2004 introduced in England Regional Spatial Strategies, which were intended to shape sustainable patterns of development across the country, and Regional Economic Strategies. In April 2010, Regional Spatial Strategies and Regional Economic Strategies were merged into a single Regional Strategy. The current Government has planned to abolish spatial planning at the regional tier, and hence Regional Strategies will no longer have any force. We return to this in Chapter 5 (Box 5B).

region's airports; biodiversity, as exemplified by problems in ensuring that the integrity of sites of international nature conservation importance is not significantly affected; and an increased risk of flooding due to climate change and the location of some new developments. The London Plan identifies similar potential environmental constraints which arise from population growth.

4.5 It is noticeable that in the wider south-east[b] there is a growing mismatch between the location of jobs and homes (Figure 4-I). Much of the new housing development planned for London is likely to take place to the east, in the Thames Gateway for example, where there is space for new building and land for development is relatively cheap and more widely available. By contrast, many of the expected new jobs will be in central or inner London, or to the south and west of the city and in the adjacent suburbs. This could have significant environmental and other costs (for example, on air quality, 4.17-4.18) as people commute long distances between their homes and their work.[2]

FIGURE 4-I
Trends in dwellings and employment in the wider south-east[3]



Housing

4.6 As we have explained, where and how people choose to live can lead to different pressures on the environment. In the UK, the Government (through planning policy) can influence to some extent where people choose to live. As part of the planning arrangements adopted by the previous Government, Regional Strategies were required to "promote sustainable economic growth", that is economic growth within "environmental limits".[4] We discuss the Regional Strategies more fully

b The 'wider' or 'greater' south-east, as noted in Chapter 2, encompasses Greater London and the South East and East of England Regions.

in the next chapter, but it is relevant here to consider the significance of environmental constraints, particularly in relation to housing. It has seemed that the starting point in many areas has been to take the projections showing an increased population and household numbers for the region, and the aspirations for economic growth as a given. In the South East Region of England, for example, the starting point was the need to accommodate the 64,300 extra people each year seeking to live in the region and to secure economic growth:[5] respecting environmental constraints was a secondary consideration.

4.7 From 2006 in England, planning for the provision of housing within each region was driven by housing targets (Table 2.I) which were generated by the Department for Communities and Local Government (CLG) using Office for National Statistics (ONS) data. Previously, Regional Planning Guidance (March 2001) set out regional housing provision and the Government's Sustainable Communities Plan (February 2003) also called for the provision of additional dwellings.[6] We heard evidence to suggest that housing targets created a tension between local and regional administrations. The Commission heard from the Chief Planner at CLG that these targets were meant to be aspirational.[7] It is clear to the Commission that others saw them as hard targets – from the local authorities' perspective, they had no choice but to accommodate the level of housing required as set out at the regional level. For England, there is evidence to suggest that, between 2000 and 2007, new-build completions increased by 26%, but, since 2007 there has been a decrease in the number of new houses being built due to the economic recession.[8]

4.8 In Wales and Scotland, planning for the provision of housing also seems to have been contentious. In Wales, an estimated 284,000[c] additional homes are required between 2006 and 2026; an average of 14,200 dwellings a year.[d] Estimates for local authority areas over the period 2006 to 2026 range from 2,500 homes in Merthyr Tydfil to 37,300 in Cardiff.[9] In Scotland, the Scottish Government aims to increase the number of new homes built each year to 35,000 by 2015; 2007 construction rates need to be doubled in order to meet this ambition. However, according to the Homes for Scotland group, barriers to the delivery of new houses include issues of consumer confidence and the overall availability of mortgage and development finance, as well as the "... severe shortfall of land being made available for housing through the planning system (leading to excessive demand over supply and fuelling past house price inflation), and years of underinvestment in the country's water and drainage infrastructure constraining development".[10]

4.9 Bristol Water noted the disparity between the level of housing provided for in the 2006 South West Regional Spatial Strategy (RSS) and the apparent need based on pre-2006 demographic projections.[11] In its evidence, Bristol Water implied that the South West RSS had underestimated the number of new houses that would be required, and this assumption was later challenged during the examination in public. During this consultation, higher levels of housing were not favoured by local stakeholders, primarily on social and environmental grounds. In 2008, the then Secretary of State (SoS) instructed a substantially higher level of housing provision compared to the original RSS as submitted (presumably because CLG had advance notice of the revised higher ONS projections based on 2006 trends). There was no assessment of the environmental impact of changes resulting from the SoS decision to direct the provision of increased levels of housing in the region and the RSS was withdrawn.[12]

c 183,000 of these homes are in the market sector and 101,000 in the non-market sector.

d 9,200 in the market sector and 5,100 in the non-market sector.

4.10 At least one local authority in the South West Region maintained it was not able to deliver the revised RSS housing provision due to the loss of green belt that would be incurred to provide the housing. The more detailed local authority spatial plans proposed some mitigation options for environmental impacts. However, in Bristol Water's view, "these [mitigation options] appear to be aspirational and modest in scope, rather than specific action plans designed to deliver clearly measurable and sustainable improvements over time".[13] The Campaign to Protect Rural England (CPRE) also drew attention to the South West RSS in its evidence.[14,e] This highlights the tensions that can arise between national Government and local authorities when it comes to planning for demographic change, and is an issue we return to in Chapter 5.

4.11 Despite the fact that Regional Strategies were subject to Strategic Environmental Assessment, the evidence received suggests that (for Basingstoke and the Wealden) these assessments did not take place at sufficiently fine a scale, or at the right time, to be able to identify possible environmental constraints.

4.12 The Environment Agency suggests that the additional investment in environmental infrastructure required to accommodate growth of 33,400 houses a year over the lifetime of the London Plan is around £3 billion. This covers the additional investment in flood-risk management, green infrastructure, household waste, water resources and water quality, and sewage treatment infrastructure necessary to support growth. The study also looked at how interventions to reduce waste and demand for water resources could reduce spending.[15] Two further studies carried out in 2009-10 looked at long-term growth projections for the Leeds City Region and Greater Manchester.

Water quality and quantity

4.13 Water quality is one potential environmental constraint. For example, the Environment Agency has identified five places in south-east England where pressing issues of water quality need to be addressed, and where it will be expensive to accommodate further development. This is because the rivers will not be able to accept further discharges of wastewater without breaching environmental quality standards such as those imposed by the Water Framework Directive.[16] This constraint could be managed by treating sewage to higher standards than at present or by moving treated wastewater to other catchments where there is capacity to accommodate discharges.

4.14 Whilst some evidence reported that water quality was of greater concern than water quantity, nevertheless, the South East and East of England Regions already face increasing demand on a limited water supply.[17] Developing new water supplies, which may involve trading between water companies or use of desalination technology, could have serious implications for energy use (and therefore carbon emissions). The new Thames Water desalination plant in Beckton in east London, completed in 2010, will only be used during times of drought or extended periods of low rainfall, or to maintain supplies in the event of an incident at other water treatment facilities.[18] This illustrates that, to meet marginal extra demand, expensive solutions may have to be used – in terms of both energy and money.

e The RSS for the South West had called for an increase in the level of new house building in the region of 15% to 40% based on the assumptions that the level of in-migration will continue and that each new job created in the region will create demand for 1.5 new dwellings. The CPRE regarded the in-migration projections as too high, and also argued that new development in the Region should be focused on areas such as Plymouth which are in need of regeneration rather than catering for further in-migration.

4.15 The draft South East RSS identified that 16,500 new dwellings were required for Basingstoke and Deane Borough Council by 2026. A water cycle study[f] undertaken for Basingstoke found that the overall water and ecological quality of the River Loddon catchment is good, but confirmed that downstream of urban Basingstoke, the River Loddon is failing to reach Water Framework Directive phosphate targets due mainly to the effects of treated sewage effluent.[19] The study concluded that additional development in Basingstoke could only be accommodated if new infrastructure was provided at the right place at the right time.[20] The Wealden area in Sussex was offered as another example of an area where decisions on housing had been made without sufficient regard to water quality issues.[21]

4.16 We were provided with information that the challenge of maintaining water quality in the face of demographic change can be addressed by technological intervention, but at a cost (3.24). For example, a total investment of £22 billion has been committed in England and Wales between 2010 and 2015 to improve assets and services and meet nearly all statutory requirements.[22]

Air quality

4.17 Air quality may be an important constraint on development, particularly in urban areas. The Environment Act 1995 set out specific objectives for improving air quality and defined the duties of public sector organisations including local authorities. These duties involve defining Air Quality Management Areas (AQMAs) and developing Action Plans. To date, 237 local authorities in the UK (over 50%) have established one or more AQMA. These are mainly in urban areas and are the result of traffic emissions of nitrogen oxides and fine particulate matter. The Action Plans are mainly aimed at reducing pollution from traffic through local management schemes, setting up 'Clean Air' or 'Low Emission' Zones and working with the Highways Agency to manage traffic flows.

4.18 This is a particular challenge in London where 33 Boroughs have declared AQMAs. The Regional Strategy for London (the London Plan) foresees significant further expansion of employment and housing and the environmental assessment of the London Plan points out the consequential increases in emissions from traffic and aviation. The draft Air Quality Strategy for the Greater London Authority[23] makes a commitment to encourage planning authorities in London and the wider south-east to work with the Environment Agency to ensure that major new developments do not worsen air quality. Further measures to improve air quality include improving road maintenance and traffic flows, congestion charging and Low Emission Zones, shifting to cleaner modes of transport, development of electric vehicle infrastructure, energy efficiency in homes and controlling dusts from construction. There is a reasonable prospect that the EU's objectives for fine particulate matter and nitrogen dioxide will not be met in the next decade in the UK. Consequently, the UK will have to seek an extension of the timelines for meeting emissions targets in urban areas set out in the recent Air Quality Directive.[24]

f The aim of a water cycle study is to help plan for the sustainable use of water by:
- bringing together the existing knowledge, understanding and skills of all partners and stakeholders;
- bringing together all water and planning evidence under a single framework;
- understanding the environmental and physical constraints to development;
- working alongside green infrastructure planning to identify opportunities for more sustainable planning; and
- identifying water cycle planning policies and a water cycle strategy to help all partners plan for a sustainable future water environment.

Biodiversity and landscape

4.19 Biodiversity and landscape were perceived by some of the people from whom the Commission heard evidence as environmental constraints to development. In the UK, a proportion of land is designated under EU and domestic regimes in order to protect the natural environment. According to a Joint Nature Conservation Committee report the total area of the UK protected by national nature designations has increased from just over 2.3 million hectares in 1996, levelling out at around 3.25 million hectares by 2008, the great majority of which are on land. Total land area in UK is 24.25 million hectares.[25] Such designations are perceived by some as being an environmental constraint on development.

4.20 In the South East Region, 35% of land is designated in respect of biodiversity or particular types of landscape.[26] As the next section of this chapter shows in more detail, the Commission found it hard to capture the constraining effects of such designations in any simple way because the degree of legal constraint will vary according to designation (4.26-4.41). The degrees of constraint are different, and designation does not automatically mean that development is not possible on such sites. Figure 4-II is a map of environmental constraints (perceived by some as impediments to development) for the South East Region which depicts the constraints to growth by group (for example, green belt, flood risk, grade 1 and 2 agricultural land, National Nature Reserves, etc.).

Waste

4.21 A significant environmental issue associated with the growth in the number of people and households in the South East Region is the growing amount of waste and how to manage it.[27] London has always been dependent on the South East Region for the disposal of a high proportion of its waste, due to a lack of landfill sites within the built-up area. London produced 22 million tonnes of waste[g] in 2008; this is forecast to rise to 34 million tonnes in 2031. The London Plan sets out the ambition that by 2031 there should be zero waste to landfill; this is to be achieved by minimising waste, boosting recycling and composting performance, recovering energy and by co-ordinating strategic waste management across the wider south-east.[28]

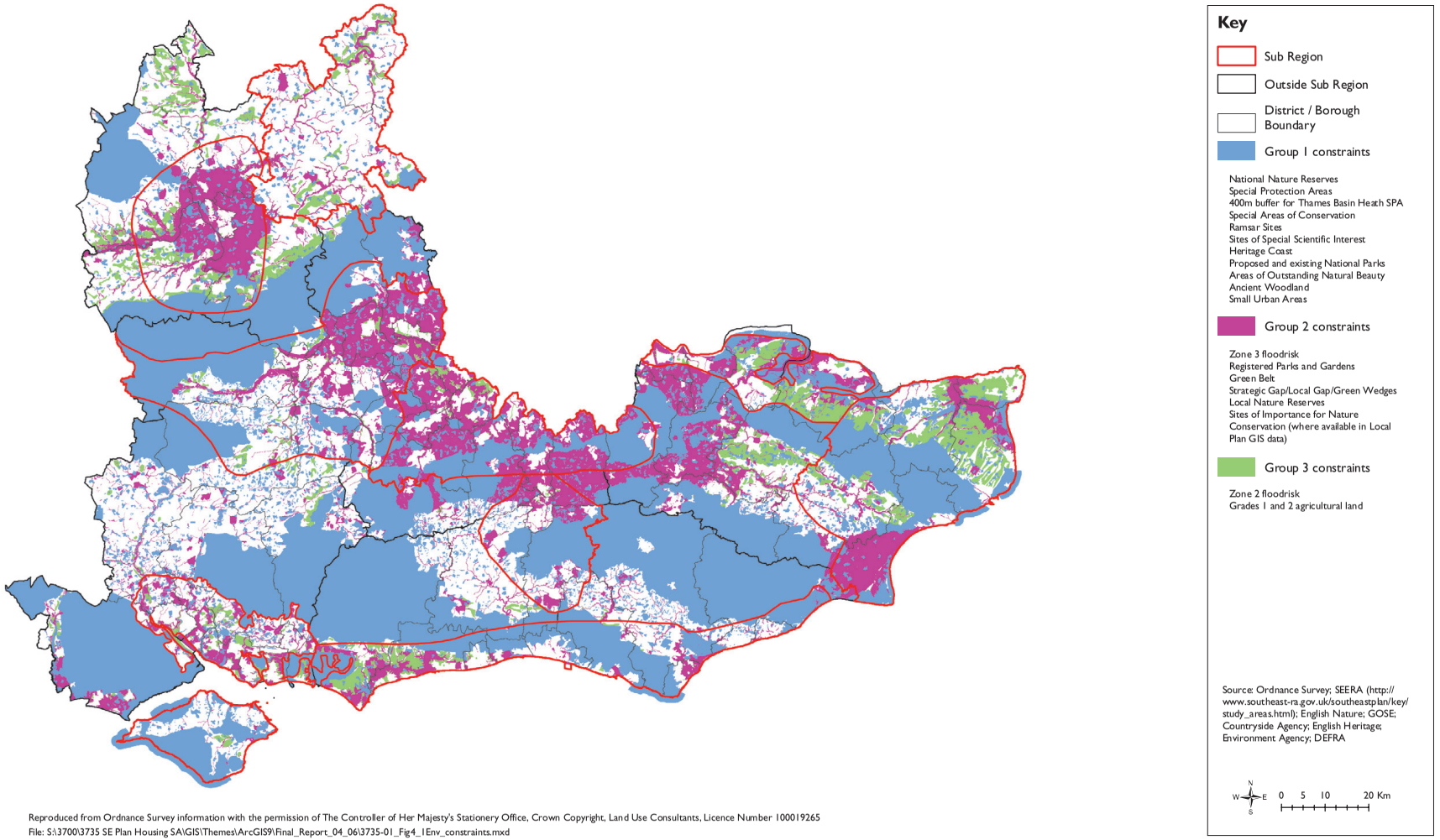
Other issues in areas of the UK outside London and the south-east

4.22 In contrast with the densely populated wider south-east, there can also be potential constraints on development in some extensive areas with populations of lower density. The population of Lincolnshire is growing fast – it is estimated to have grown by 7% between 2001 and 2007 while the UK population grew by 4% – though the average density of population (118 people per km^2) is less than a third of the UK average (395 people per km).[29] The Regional Spatial Strategy for the East Midlands (which includes Lincolnshire) envisaged a 44% increase in housing in the county over the next twenty years.[30] A key environmental challenge is that much of the land in Lincolnshire is at or below sea level. Consequently, the risk of inundation needs to be managed, suggesting that flood risk could act as a constraint to development. Moreover, much of Lincolnshire is prime agricultural land – the county is responsible for nearly a quarter of the UK's vegetable production. Protecting this is an important consideration which may act to constrain development.[31]

g 'Waste' in this instance includes municipal household waste, commercial and industrial waste, and construction, excavation and demolition waste.

FIGURE 4-II
Map of environmental constraints in the South East[32]

This complex but interesting map shows the environmental constraints, perceived by some as a constraint on development, for the South East Region of England. The constraints are grouped into three types, which include green belt and grade 1 and 2 agricultural land.



4.23 Inverness, as mentioned in Chapter 3, has undergone considerable expansion in recent years, rising in population from 51,000 in 2001 to 60,000 in 2007, making it one of Western Europe's fastest growing cities in percentage terms.[33] Although the Highlands and Islands of Scotland is a sparsely populated region, future expansion will be concentrated to the east and south, in the A96 corridor towards Nairn. In 2003, Scottish Ministers endorsed the City Partnership's vision of a further 30,000 people to be housed in the corridor over the next 30 years.[34] (As mentioned in Chapter 2 (2.28), the Scottish Government has a policy to encourage inward migration in order to increase the size of the Scottish population.) Such considerable and rapid expansion will necessitate significant infrastructural developments and will lead to the loss of a sizeable area of agricultural land, as well as potentially drawing population from other parts of the Highland area which are already in decline.[35]

4.24 Similarly, the Welsh Assembly Government is responding to the depopulation experienced in the Heads of the Valleys in recent decades by funding extensive redevelopment of the former steelworks site in Ebbw Vale. This redevelopment includes a new hospital, new housing, a learning centre, improvements to the natural landscape and an extension to the railway line servicing Cardiff so that there is now a station in Ebbw Vale.[36] This raises the concern that this redevelopment could encourage people to commute longer distances from home to work in Cardiff, with implications for the environment. There are, however, deeply embedded views as to the sense of community and quality of life in the Valleys, and we did hear evidence that attracting people back from the city was likely to take more than an improvement in physical conditions and transport services.

4.25 In conclusion, we received considerable evidence that providing the infrastructure associated with a growing population presents real environmental challenges in some areas. In some cases, these challenges were described to us as 'environmental limits' that posed a real block to 'more' people. We decided that we needed to explore what this means in more detail.

Environmental limits or environmental constraints?

4.26 The terms 'environmental limits' and 'environmental constraints' are used widely, and featured in the evidence we received. But they are not the same thing. The evidence received suggests that there are also different understandings and uses of the term 'environmental limits'. The Commission heard much discussion around whether the UK can accommodate population and economic growth "within environmental limits", especially (but not exclusively) for the south-east.[37] The current discussion of environmental limits is a revisiting of the 'limits to growth' debate that was at its height in the 1970s, stimulated by the report of the Club of Rome.[38] The intellectual evolution of 'limits to growth' is complex and important, but essentially the limits thesis implied that only radical social and economic reform, including an end to growth, could save us from ecological catastrophe. Even this was apparently problematic: the predominant style of analysis suggested that 'overshoot and collapse' was the most likely outcome, and this meant that effective human intervention to avoid such extreme outcomes was regarded as unlikely. There was therefore a danger that the logical extremes of the limits thesis would effectively disallow practical political responses to environmental degradation, particularly at the global level.

4.27 As a result, and again simplifying, 'limits to growth' has been largely displaced in the political mainstream by 'sustainable development' from the 1980s onwards. In particular, a sustainable development framework sought to allow developing and developed countries to make progress on environmental protection alongside development and economic growth. One of the seminal reports on sustainable development, the Brundtland Report, does refer to environmental limits,

but there is an assumption that those limits are not absolute and can be pushed outwards by human ingenuity.[39] By contrast, one of the central tenets of the purest forms of limits to growth was that technical fixes would at best postpone rather than avoid environmental collapse.[40] The language of limits within sustainable development is simply part of the sensitive balance between that concept's economic, social and environmental elements. In a reflection of the concern that sustainable development has prioritised social and economic issues over environmental protection,[41] environmental limits have been re-emphasised recently, including in the 2005 UK Sustainable Development Strategy[42] and in regional planning.

4.28 The meaning of limits is far from clear. People affect the physical environment in ways that can make life unfulfilling, uncomfortable or even unbearable, but each person has his or her own view of what makes life fulfilling, comfortable or bearable. And there are physical environmental limits for the survival of particular species or ecosystems, in particular places and at particular times, or globally. But the task of identifying environmental limits demands more than an assessment of the biophysical properties of a natural resource system; it also requires the exercise of political judgement about how much environmental damage a group or society is prepared to accept.[43] Crudely, how much does society care about these species, for example, in this place and at this time? The 2005 UK Sustainable Development Strategy reflects this: "Environmental limits are the level at which the environment is unable to accommodate a particular activity or rate of activities without sustaining unacceptable or irreversible change."[44] Similarly, evidence received from the Campaign to Protect Rural England makes the point that it is not possible to reach a view on environmental capacity purely on scientific grounds, since value judgements have to be made on "what society regards as the acceptable form and rate of environmental change."[45]

4.29 Given that environmental limits are partly physical and partly about the way people choose to live, they are also partly about what society is prepared to pay for a particular way of life. Working out what might need to be paid (in economists' language, 'abatement costs') to avoid or mitigate environmental damage is generally not in principle problematic. Abatement technologies, for example desulphurisation plants attached to power stations, can be purchased in existing markets. The economists' approach is then to compare these abatement costs with the costs of environmental damage and find some balance between the two. The economic interpretation of limits involves working out where damage costs rise very steeply beyond a certain point, and could in principle approach infinity at the margin.

4.30 However, it is usually much more difficult to place a value on environmental damage than on abatement, because markets generally do not exist in environmental damage. In seeking to find an economic balance between the costs of damage and the costs of abatement, it is therefore necessary to resort to a range of techniques that aim to infer the value of damage by indirect means. These techniques are based on working out people's willingness to pay to avoid or abate damage, and have significant limitations. Apart from some technical problems in reaching meaningful valuations using these methods, there is a fundamental problem that people's willingness to pay is constrained by their ability to pay. If the logic of this is pursued, there is an implication that environmental damage is relatively less important in developing countries than richer countries, or in poorer areas of industrialised countries, because willingness to pay is lower than in more affluent areas. For both these technical and ethical reasons, attempts to use economic valuation of environmental damage as the basis for policy decision based on a comparison between abatement and damage costs is problematic and often rejected by democratic political processes. Economic

analysis may inform choices about how much to spend to avoid limits or constraints, but is not able to pronounce definitely on the 'correct' balance between the two types of cost. The question of how much to spend on abatement then becomes a fundamentally political choice.

4.31 In summary, the language of environmental limits is at best uncertain, and at its worst it implies that there are absolute and predictable barriers to growth. It is always risky to introduce fresh linguistic distinctions, but the Commission prefers, as in our 23rd Report, to talk of environmental constraints.[46] Environmental constraints are real, as are the environmental, economic and social costs of ignoring them. As will become clear in this report, the Commission has reached conclusions on where some of the most serious constraints lie. But environmental constraints are not simple, absolute and predetermined and they are intrinsically related to judgements about the way people live, the acceptability of physical and social quality in an area, and the costs that society is willing to bear.

Environmental constraints defined by law

4.32 Much of the evidence we received about limits actually based those limits on legally defined thresholds – for pollutants for example. The Commission has become aware of a tendency to define 'environmental limits' by reference to legal limits;[47] the environmental standards embodied in legislation are viewed by some as defining the point at which environmental limits would be breached. It is certainly plausible that a widely shared judgement about the way we wish to live might be found in legislation. And certainly, some legislation is very hard edged. The EU's Ambient Air Quality Directive, for example, lays down some clear, quantitative ceilings on the presence of specified pollutants in the air; and 'daughter directives' adopted under the Water Framework Directive impose limits on the concentration of priority hazardous substances. There are many more examples. And by the time legislation is applied 'on the ground' (in a licence or permit), general standards may have been translated by the regulator into fixed numerical standards with which the regulated party simply must comply.

4.33 But a distinction between legal requirements and environmental constraints should be maintained for at least two reasons. First, at any given moment, legal provisions may or may not coincide with a community's assessment of what environmental constraints require. Local needs and preferences, or a difference in scientific opinion, as well as particular existing environmental problems, may result in a finding that some centrally set standards do not go far enough, particularly where new development is proposed. Legal compliance does not necessarily mean that environmental constraints are sufficiently respected.

4.34 Many environmental responses to pressures created by economic and population growth increase gradually without specific step changes – as is the case with many aspects of responses to climate change, effects of air and water quality on human health and habitat fragmentation, or of water abstraction on biodiversity. Consequently, setting standards through legislation often requires scientific and societal judgements on the level of *unacceptable* or *irreversible* change.[48] Furthermore, regulatory action also has to recognise the limitations of available technology and the need to avoid excessive costs. Further difficulties arise when emerging scientific evidence results in more exacting legislative standards (as has happened in recent years in terms of EU regulation of air quality and water quality for example), which can have major implications for existing plans to accommodate economic and population growth in specific regions.

4.35 Moreover, to assume that legal limits are always simple and absolute risks misunderstanding the nature of contemporary environmental law. Much environmental legislation provides a framework for decision making, rather than clear prohibitions or quantitative standards that simply must be obeyed. The standards that are included in regulations may be broadly expressed framework standards, often accompanied by wide-ranging exceptions which permit derogation in particular circumstances (see Box 4A). This combination of open-ended standards and flexible exceptions means that environmental legislation does not often contain clear legal limits.

BOX 4A LEGAL CONSTRAINTS AND ENVIRONMENTAL CONSTRAINTS

The Water Framework Directive (WFD) provides a useful illustration of the open character of much contemporary environmental law. Member States must prevent deterioration in the status of water bodies and aim to achieve good water status by 2015.

The meaning of the Directive's core concepts – no deterioration and good water status – remains contested. For example, there is debate about whether the 'no deterioration' principle is limited to an obligation to prevent a downgrading from one water status class to another (good to moderate for example), or whether it is also concerned with deterioration *within* a single class. We have heard that the meaning of deterioration is subject to discussion between the Environment Agency and water companies in specific cases. There is clearly considerable flexibility for the Environment Agency in any particular context. It is possible that this flexibility will be closed down by decisive interpretation from either the Environment Agency or by the courts (a judicial review is expected), but some flexibility in defining 'no deterioration' is likely to remain.

The Directive's broad environmental objectives are also subject to a number of important exceptions. Most of these exceptions posit 'no deterioration' as the environmental bottom line. However, two of the exceptions included permit derogation from the no deterioration obligation as well. Article 4(6), for example, permits temporary deterioration in the status of water bodies where this is the result of circumstances of natural cause or *force majeure*; where these circumstances are exceptional or could not reasonably have been foreseen. Extreme floods and extreme droughts are offered as examples. More significantly, Article 4(7) permits failure to achieve the WFD's environmental objectives, including the no deterioration obligation, where this failure is a result of new modifications to the physical characteristics of a surface water body or alterations to groundwater bodies.[h] This exception is subject to a range of conditions, including an obligation to mitigate adverse impacts where practicable, and to ensure that significantly better environmental options are used where these are not excluded for reasons of technical infeasibility or disproportionate cost. In addition, the reasons justifying the physical modifications or alterations must be of overriding public interests *or* they must provide benefits to human health/safety or to sustainable development which outweigh the benefits of achieving the Directive's environmental goals.

The end result is that sustainable development and/or human health and safety may sometimes justify deterioration in water status (even between water status classes). The concept of sustainable development is not defined. Consequently, the legal constraints of this Directive are in part about the exercise of context-dependent judgement and a complex balancing of environmental, social and economic concerns.

h This is found in Article 4(7), first sub-paragraph. The second sub-paragraph also allows departure from the no deterioration obligation, but only sanctions deterioration from high status to good status and is thus much more limited in its scope.

4.36 There is sometimes a temptation to claim that environmental legislation mandates a particular result in relation to a particular activity. We saw for example a perception on the part of some practitioners that the existence of a green belt legally precludes building in a particular area (Box 4B). Whilst there are significant constraints on development in the green belt, the law and policy set a framework to control decision making on development in 'exceptional circumstances', rather than barring all development.[49]

BOX 4B GREEN BELTS AS A 'LIMIT' ON DEVELOPMENT

Different designations of land impose different legal requirements on its development. Equally importantly, the perception of the constraints imposed by designation also differs. Green belts are often presented as an absolute limit on physical development. Green belt policy as it stands certainly imposes some constraints; however, the legal constraints are not absolute and the political sensitivity of green belts is probably more important. Whilst the abolition of regional planning makes changes to the way green belts function inevitable, the Coalition Agreement of the current Government states very clearly that "We will maintain the Green Belt";[50] the basic principles are likely to remain.

The current guidance on green belts is found in Planning Policy Guidance Note 2, *Green Belts* (1995, amended 2001) (PPG2). Green belts are designated in plans at regional and local level. According to PPG2, the "essential characteristic" of the green belt is "permanence", and any changes have to be justified by "exceptional circumstances".

There is a general policy presumption in PPG2 against "inappropriate development" in the green belt. New building is generally considered "inappropriate".[i] "Very special circumstances" are needed to justify inappropriate development, and "very special circumstances to justify inappropriate development will not exist unless the harm by reason of inappropriateness, and any other harm, is clearly outweighed by other considerations". This policy has been subject to a great deal of litigation.[51] It imposes real legal obligations on local authorities, but rather than hard legal boundaries, there is a balance to be drawn as a matter of planning judgement.

Whilst there are significant constraints on development in the green belt, the legal requirements imposed by green belts are not as hard edged as they are sometimes perceived to be.

Conclusion

4.37 The nature of environmental constraints needs to be properly understood. Environmental impacts such as those on air and water quality are real, but the extent to which they constrain development is not simple or predetermined. The degree to which environmental impacts constrain development reflects judgements about competing societal and economic priorities. There is no simple relationship between environmental constraints and legal 'limits'. Only rarely will legal requirements impose a clear and absolute prohibition on development; far more often they impose a varying framework of conditions or processes that must be met during the consideration of development. We are not suggesting that law can be ignored, or that it is all a matter of opinion – but often, the role of environmental law is to provide a framework for the exercise of

i The construction of new buildings inside a green belt is inappropriate unless it is for particular purposes, including agriculture and forestry, essential facilities for outdoor sport and outdoor recreation, for cemeteries and for other uses of land which preserve the openness of the green belt and which do not conflict with the purposes of including land in it.

political judgement. Nevertheless, these sorts of constraints, imposed by a range of different legal instruments, can be extremely useful for the scrutiny of the environmental impacts of development. We return to these issues in the next chapter.

4.38 Although it appears that there are large amounts of land which could be developed, we have seen in this chapter that environmental constraints on development do exist, and that addressing these is often likely to be costly, sometimes in environmental as well as economic terms. While we have seen some attempts to quantify the economic cost of addressing environmental constraints, the Commission is not convinced that the scale of these costs is always appreciated or adequately taken into account.

4.39 Evidence from Surrey County Council on the Surrey Infrastructure Capacity project brought to our attention the EU Smart Economic Growth Project.[52] This study reviewed the possibilities for combining economic growth with environmental enhancement, both in relation to resource use and the overall ecological footprint of an area, and placed great emphasis on trying to reduce the transport associated with economic growth. The study suggests that growth is probably not compatible with environmental improvement without stronger state intervention to both influence patterns of migration and enhance local employment opportunities, so that people might be able to work where they live, thus reducing or even avoiding commuting, and minimising business travel. The Commission was at least encouraged that Surrey was alert to the tension that exists between economic growth and the desire for continued environmental enhancement.

4.40 The Commission has used the language of environmental constraints as opposed to the now more widely used language of environmental limits. This is because the language of limits suggests something which is fixed and absolute, whereas the Commission believes that an assessment of how much environmental damage a group or society is prepared to accept is often a matter of political judgement. This is not to suggest that science, economics and law cannot assist in exercising this judgement, but merely that they cannot be relied upon to provide unequivocal 'right answers'.

4.41 The emphasis we place upon the political nature of decisions about how much environmental damage to accept, and how much to spend in seeking to address it, leads us to acknowledge the importance of decision-making processes. We consider in the next chapter some of the processes for spatial planning, and within that system how the processes for environmental assessment address issues around local and regional changes in population, associated infrastructure and environmental impacts.

Chapter 5

The spatial impacts of demographic change

5.1 In Chapter 4 we saw that, in local and sometimes wider regional contexts, demographic change can lead to significant environmental pressures. These may be difficult and costly to accommodate. In this chapter we examine some of the policy interventions which can either seek to influence where people choose to live, with a view to reducing some of those pressures, or to mitigate the environmental pressures which may arise when development does go ahead in response to the demands of demographic change. Specifically, we describe first the scope of spatial economic policies intended to influence where people choose to live. We then look at two aspects of the spatial planning system, which has a central role in determining where housing and other infrastructure are built. These aspects are the recent changes, in England, to a system based on greater localism and which gives greater influence to local communities in making decisions, and the way in which assessment techniques have been used to assess the potential environmental consequences of planning options before a decision is made.

5.2 This report was written during a time of great change in relation to how spatial and environmental issues are dealt with, and it aims to highlight a number of the key challenges that need to be addressed within any new governance regime.

Economic development policies

5.3 Over the years, governments have adopted many policies aimed at influencing both the distribution of the population and environmental quality. These have included direct interventions to create new communities in particular locations. For example, in the 1940s, the perceived problem of the expansion and overcrowding of London was managed by creating New Towns on land which was acquired at agricultural use value by the Treasury (see Box 5A), something which probably could not be repeated now on the same scale or at similar costs.

5.4 Recently, 'Millennium Communities' and the Ecotowns programme have aimed to address the challenge of accommodating new housing while also achieving sustainable, high quality design. Major infrastructure projects, such as the Olympic site in east London (with substantial investment in infrastructure including transport links) or the proposed high-speed rail line from London to Birmingham may also have an influence on where people choose to live.

5.5 Some of the most significant policies influencing where people live and work have, however, been those concerned with regional economic development. It is important to recognise the drivers of demographic change, in order to understand how far policy intervention can shape or change trends directly. Economic considerations are a key driver of population change. The importance of economics is often overlooked or underplayed in debates about demographic change. People primarily move – between countries, between regions and more locally – in response to economic opportunity. The UK experiences net in-migration when its economic prospects compare favourably with opportunities elsewhere. For example, London and the south-east of England gain population because they generate expanding opportunities for employment, whereas the Western Isles of Scotland experience decline in population because local opportunities are more restricted or falling, and opportunities elsewhere in the UK are better.

BOX 5A NEW TOWNS AND ECOTOWNS

The term 'New Town' is used to refer to the towns developed after World War II under the New Towns Act 1946 to accommodate people who had lost their homes during the war. There was also a concern around the same time that the population of London was expanding too rapidly, and this expansion needed to be controlled and halted.

New Towns created following the 1946 Act include Stevenage in Hertfordshire (the first New Town), Bracknell in Berkshire, East Kilbride in Lanarkshire and Cwmbran in Monmouthshire. 28 New Towns were created in total. In Northern Ireland, the building of Craigavon in County Armagh commenced in 1966 between Lurgan and Portadown. The area, which now has a population exceeding 90,000, is mostly a dormitory town for Belfast.[1]

New Towns were financed by the Treasury which acquired land within the designated area at agricultural use value for the development corporation for each town; infrastructure and building funds were borrowed on 60-year terms from the Treasury. By the 1970s the New Towns began to reach their initial growth targets. As they did, their development corporations were wound up and the assets disposed of: rented housing to the local authority, and other assets to the Commission for the New Towns (in England, alternative arrangements were made in Scotland and Wales).

Twenty-first century New Towns are currently being created under the Millennium Communities Programme, which is similar to the New Towns Policy of 1946, although the developments created under this scheme are usually smaller and tend to represent expansions of existing urban areas rather than entirely new developments. Examples of twenty-first century New Towns include Allerton Bywater in West Yorkshire and the Greenwich Millennium Village in Greater London.

The previous Government also introduced a programme of building new Ecotowns, which were intended to demonstrate exemplary standards of sustainability. Although supported by some organisations, they also attracted controversy and scepticism. On 16 July 2009, the then Government announced the four successful Ecotown bids: Whitehill–Bordon (Hampshire), St. Austell (Cornwall), Rackheath (Norfolk) and north-west Bicester (Oxfordshire).

5.6 Since at least the 1930s, governments have adopted a range of policy measures to seek to direct economic growth to the less prosperous parts of the UK. At different times these have had a social dimension (to alleviate high levels of long-term unemployment in some regions) or an economic rationale (to maximise economic potential by diverting development away from London and the south-east and putting underused resources in other regions to more productive use).

5.7 The Commission asked Professor Steve Fothergill, of the Centre for Regional Economic and Social Research at Sheffield Hallam University, to provide a short assessment of the effectiveness of regional economic policies in the UK, and the effects which such policies have had on migration.[2] His assessment, which is not shared by all analysts, demonstrates that action to alter the regional distribution of population is feasible and, in the past, has had substantial impacts. Specifically, past policies have at times maintained higher populations in economically less-favoured regions than would otherwise have been the case.

5.8 The fact that regions which have previously been supported may still need assistance does not mean that the policy has failed. Professor Fothergill notes that there have been considerable changes in the UK's economy – traditional industries such as coal, shipbuilding, steel and heavy

engineering, which underpinned the economies of large parts of northern England, Scotland and Wales, have disappeared. Yet very substantial populations and economic activity remain in those places. To understand the contribution of regional policies requires a comparison of what has happened with what would have happened had such policies not been implemented.

5.9 The evidence suggests that, between the 1960s and the 1980s, regional economic policies diverted 600,000 manufacturing jobs to the four main assisted regions,[a] of which 450,000 jobs remained in the early 1980s. The gross cost per job to the Exchequer averaged £40,000 at 1981 prices. The evidence is less clear for later periods, but Professor Fothergill concludes on the basis of various studies that regional economic policy does alter the location of economic activity, though it is not possible to determine reliably either the size of the impact or the cost-effectiveness of current regional economic policy. In future, because the UK is now part of the European Union (EU), with an internal market and freedom of movement for labour, the patterns of migration in response to economic factors (including regional economic policies) will operate at a European rather than simply a national level.

5.10 Professor Fothergill concludes that the main impact of job creation attributable to regional policy is on the distribution of population. Rather than drastically lowering unemployment in the assisted areas, the main impact has been to stabilise their population levels. The population of the assisted regions may be as much as 2.5 million higher as a result of these policies (when the impact of the non-working-age population, that is children and those who are retired, is taken into account). Successful regional policies may alter the distribution of population via their impact on migration, and the impacts are potentially very large (but surprisingly are often overlooked). The regions with the weakest local economies have the lowest rates of both in- and out- migration: the local population is most stable. The volume of migration tends to rise and fall with the economic cycle.

5.11 Professor Fothergill's evidence suggests that it should be possible to ease the population pressure in the south-east of England by promoting regional economic development in the rest of the UK – though such a policy would not be cheap. But it is important to compare the costs of achieving change in regional population distribution with the costs of accommodating the environmental consequences of a continued concentration of population in certain parts of the UK, most notably the south-east. We return to this point in the next chapter. Professor Fothergill emphasises that some instruments are more cost-effective than others: on the basis of the evidence, discretionary grants are cheaper in terms of the Exchequer cost per job than automatic financial incentives, and blanket labour cost subsidies are the least cost-effective of all.

5.12 Any regional policies must take account of the EU rules on 'state aids'. These prohibit aid to industry where it is granted on a selective basis, such as to firms in particular geographical regions.[b] This general ban is subject to a number of exemptions, including where aid forms part of a national regional policy. In 2006, the European Commission adopted guidelines which set out the circumstances under which particular regions may benefit from state aid including, for example, direct investment grants and tax reductions for companies, up to specified ceilings (in the most deprived areas, the aid must not exceed 30% of the cost of a project).[3] According to the

a i.e. Northern England, Scotland, Wales and Northern Ireland.

b Aid granted to all enterprises within Scotland, Wales or Northern Ireland by the UK Government would still constitute selective aid for the purpose of EU law. However, where one of the Devolved Administrations grants aid when acting in an area in which it enjoys policy autonomy, it is likely that the aid would not be viewed as selective, and hence not as state aid, so long as it is granted to all enterprises within the relevant area. See ECJ case C-88/03 *Portugal* v. *Commission*.

UK's latest regional aid map, 23.9% of the population lives in areas currently eligible for regional aid. Environmental investment aid is also permitted in some circumstances,[4] and even outside of areas entitled to regional state aid, other exemptions may apply – for example, aid may be granted to small or medium enterprises to cover a proportion of the eligible costs of employing people.[5] So while national regional policy must give careful consideration to EU state aid rules, these rules are sufficiently flexible to permit an effective national regional policy to be put in place.

5.13 The previous Government set out in one of the Public Service Agreements objectives the need to "improve the economic performance of all the English regions and reduce the gap in economic growth rates between regions".[6] All regions had strategies for economic development (which were subsumed into regional strategies), and Regional Development Agencies aimed to create sustainable economic growth across England.

5.14 The current Government has not set out such specific objectives on regional development. It is, however, clear that the Government does recognise the importance of this issue: the Prime Minister said in May 2010:

> "Today our economy is heavily reliant on just a few industries and a few regions – particularly London and the South East. This really matters. An economy with such a narrow foundation for growth is fundamentally unstable and wasteful – because we are not making use of the talent out there in all parts of our United Kingdom."[c]

5.15 In the July 2010 budget the Government announced a Regional Growth Fund to support business employment and growth.[d] The £1 billion fund, designed to help areas and communities at risk of being particularly affected by public spending cuts, will operate in 2011/12 and 2012/13. Both private bodies and public–private partnerships will be able to bid for funding by demonstrating that their proposal will bring in private investment and support sustainable increases in private sector jobs and growth in their area. As the institutional arrangements for managing and distributing the Regional Growth Fund take shape, it will be critical to ensure that arrangements are put in place to assess and manage the environmental impacts of the projects. There is also a National Insurance 'holiday' for two years from September 2010 available to qualifying businesses outside the London and the South East and East of England Regions.[7]

5.16 In other parts of the UK, the Devolved Administrations have also adopted policies for economic development, which are an important part of their national strategies. It is particularly relevant that the Scottish Government has a specific target for population growth, i.e. to "match average European (EU-15[e]) population growth over the period from 2007 to 2017, supported by increased healthy life expectancy in Scotland over this period".[8] Population growth in Scotland is seen as closely related to economic performance – with the growing population being necessary to maintain growth, and growth providing the driver to reduce emigration from, and promote immigration to, Scotland.

c See: http://www.number10.gov.uk/news/speeches-and-transcripts/2010/05/transforming-the-british-economy-coalition-strategy-for-economic-growth-51132 for full transcript of speech.

d This was in part also to compensate for the abolition of the Regional Development Agencies.

e EU-15 refers to the 15 member countries of the European Union prior to May 2004.

Planning for the spatial impacts of demographic change

5.17 While economic policies may be important instruments influencing demography, Professor Fothergill concludes by noting that administrative controls may be the most cost-effective instruments of all. We therefore now turn to the spatial planning system, the principal instrument by which the implications of demographic change can be managed, and particularly the demand for new housing (and related infrastructure) which flows from the growing number of households.

5.18 The Commission has dealt extensively with the spatial planning system in previous reports,[9] and we will not cover the same ground again. However, there are two aspects which are important to consider here. The first is the implications of reforms currently being undertaken in England aimed at making the system more responsive to local needs and more democratically accountable. The second concerns how assessment techniques, such as Strategic Environmental Assessment, have been and will be used to ensure that environmental implications are identified and taken into account in spatial development decisions, in short, how environmental issues are integrated into planning. These two issues are, of course, inter-related.

5.19 The spatial planning systems differ in different parts of the UK. In England, most recently, Regional Strategies formed an important tier in the planning system itself. The key components were the Regional Strategies for London and each of the eight other English Regions. Local authorities prepared Local Development Framework documents (based on a 15-20 year time frame), which were required to be consistent with the Regional Strategy, and identified specific locations for development.

5.20 The current Government is abolishing the regional tier of the English planning system (outside London), and Regional Strategies will no longer impact on planning decisions. They do, however, provide recent experience of how environmental factors and environmental constraints have been identified and dealt with in spatial planning. Box 5B sets out how Regional Strategies were prepared in England and we draw conclusions from this experience in this chapter and the next.

BOX 5B CHANGING GOVERNANCE ARRANGEMENTS FOR STRATEGIC PLANNING[10]

The spatial planning system in England, which operated until recently, was established in 2004 by the Planning and Compulsory Purchase Act 2004. This emphasised 'spatial' rather than just land use planning but this time at the regional scale by introducing into England for the first time a statutory regional planning tier in the form of the Regional Spatial Strategy (RSS) which replaced the earlier non-statutory Regional Planning Guidance (RPG). Hence the spatial planning system in England operated at three statutory tiers – local, through local development frameworks, regional, through Regional Strategies (there are nine regions, including London); and national, through call-in powers and National Policy Statements. The previous Government regarded the regional planning tier as the key strategic development tier to positively promote sustainable patterns of development across the country.

It proposed that Regional Strategies would: shape the delivery of economic growth across sub-regions and regions; inform the distribution of housing supply and targets for affordable and market housing, identifying broad locations for Growth Points and Ecotowns; positively respond to the risks and opportunities of climate change, including the need to reduce carbon emissions; identify sub-regions such as the Black Country, East Lancashire and other areas as priorities; and provide strategically for transport, waste, water, minerals, energy and environmental infrastructure.

At the non-statutory level, the planning process also operated at the sub-regional (e.g. the Thames Gateway) and inter-regional (e.g. the Northern Way) level. Regions that shared borders with Wales and Scotland also promoted inter-regional planning strategies which were mutually beneficial. For the English Regions, the Regional Strategy was to have been an amalgamation of the Regional Spatial Strategy and Regional Economic Strategy.

The purpose of the Regional Strategy was to set out the spatial vision for the sustainable development of a region over a 15 to 20-year time horizon. It was drafted, implemented and monitored by the responsible regional authority (RRA), which consisted of a Leader's Board (leaders of local authorities in the region) and the Regional Development Agency. Draft spatial plans were subject to Habitats Regulations Appropriate Assessment (HRA), Sustainability Appraisal (SA) and Strategic Environmental Assessment (SEA). Draft plans were subject to consultation and challenges and revisions to the strategy could be proposed, and then scrutinised during the examination in public (EiP) phase. Finally, the plan was submitted to the Secretary of State for Communities and Local Government and eventually published as a revised Regional Strategy.

London has its own strategic plan in the form of the London Plan. Although there is still an EiP phase, the London Plan, unlike other regional strategies, does not have to be submitted to the Secretary of State. This is because London has an elected Mayor and Assembly.

The Government announced in July 2010 the abolition of the regional tier of planning, and (apart from the London Plan) Regional Strategies no longer have effect.[f]

5.21 In the Devolved Administrations regional policy focuses on economic development and is developed alongside, but not as part of, land use planning policy. In Scotland, Scottish Ministers are responsible for a National Planning Framework (NPF) which sits at the top of the policy hierarchy and is the long-term strategy for the country's development. The second National Planning Framework (NPF2) was published in June 2010 and is intended to guide Scotland's development to 2030, setting out strategic development priorities to support the Scottish Government's central purpose – sustainable economic growth. It provides a national context for development plans and planning decisions, as well as informing the ongoing programmes of Government and agencies.

5.22 In 2005, Scottish Ministers introduced Strategic Development Plans (SDPs) and Local Development Plans (LDPs). Whilst LDPs cover the whole of Scotland, SDPs only cover the four largest city regions around Aberdeen, Dundee, Edinburgh and Glasgow. SDPs are prepared by Strategic Development Planning Authorities in each of the four city regions and approved by Scottish Ministers. They are required to set out a clear vision and spatial strategy for their area. Critically they will focus on the key land use and development matters that cross planning authority boundaries. LDPs sitting below this provide further detail on issues specific to the local authority area, in line with the overall strategy contained within the SDP.

5.23 Wales has the Wales Spatial Plan,[11] which provides the overarching framework and integration tool to underpin decision making in a wide range of areas including economic development, regeneration, capital investment, transport and public services. The Wales Spatial Plan is led by the Minister for Finance and Public Service Delivery, whereas land use planning comes under the leadership of the Minister for Environment, Sustainability and Housing. 'Planning Policy Wales'

f The High Court declared in November 2010 that the Secretary of State's letter seeking to disapply Regional Strategies from July 2010 was unlawful. Formal abolition of the Strategies will therefore depend on primary legislation.

(March 2002, revised July 2010)[12] sets out land use planning policy for Wales, and is supplemented by a series of Technical Advice Notes (TANs). Together with circulars and policy clarification letters, they comprise the National Planning Policy for Wales.

5.24 In Northern Ireland, the Regional Development Strategy (RDS), '*Shaping Our Future*', is a framework for the development of Northern Ireland up to 2025.[13] It contains a Spatial Development Strategy and related Strategic Planning Guidelines which provide the context for local planning policy. Development plans set out more detailed policy at a local level and consist of maps and written policies, which show where various types of development will be permitted. Development plans are prepared by the Planning Service, an Agency within the Department of Environment.

Regionalism and localism

5.25 As part of its broader agenda of localism, the current Government is changing planning law and policy to extend decision-making powers at the local level. The aspiration is for a more democratic system, and, in the longer term, for radical reform that will allow inhabitants to shape the neighbourhoods in which they live.

5.26 The precise shape of this 'localism agenda' is not yet clear, but some key steps have been announced. First and most significantly, the regional tier of planning has been abolished, so that there is no longer any formal tier of spatial planning between the national and the local levels in England. This could have potentially important planning implications, to which we return below, but also a range of implications for other activities that used to be done 'regionally'. For example, we heard concerns that strong mechanisms for organising demographic and environmental data at the regional level must not be lost as a result of the abolition of the regional planning tier and the Regional Development Agencies. We return to this in the next chapter.

5.27 As well as abolishing the regional tier, the Government intends to reduce the volume of national policy guidance. The current system of national planning guidance will be replaced with "a simple and consolidated national planning framework covering all forms of development and setting out national economic, environmental and social priorities", which will be presented to Parliament.[14] The Scottish Government has already undertaken an exercise of this nature, replacing a suite of over 20 topic-based National Planning Policy Guideline documents, each typically around 20-30 pages in length, with a consolidated Scottish Planning Policy running to under 60 pages.[15]

5.28 The Government has proposed a 'community right to build' as part of a new Localism Bill.[g] The community right to build would allow communities to take forward developments for new homes, shops and facilities in their area without planning permission, provided certain criteria are met.[16] The precise criteria are not yet in place, but the Department for Communities and Local Government (CLG) has suggested that these "might include":[17]

- Demonstrating strong local approval for their planned development – with no more than 10% opposition in a formal community referendum;
- That the proposal does not expand the size of the community by more than 10% over any 10-year period; and
- Meeting sustainable development and environmental criteria.

g The Bill was due to be published in November 2010, after this report was sent to print.

5.29 The recent change in the policy regarding building in gardens provides an example of new approaches. Until recently gardens have been classified as brownfield sites. The Commission recommended in its 26th Report, *The Urban Environment,* that CLG and its devolved equivalents ensure that planning policy and guidance recognise that not all brownfield land is equally suitable for development, because gardens and other areas may provide ecosystems and amenity services if left undeveloped.[18] In June 2010, the Government announced it would reclassify gardens to be regarded as greenfield rather than brownfield sites.[19] This was designed to give local authorities more flexibility in decision making over these developments but may also have an impact on environmental quality either positively by safeguarding urban biodiversity or negatively by pushing development into other greenfield sites.

5.30 It is clear that the increased emphasis on localism within the planning system brings with it certain challenges. The key issue is whether local authorities take decisions which give sufficient importance to national, regional, or cross-boundary issues.

5.31 From an environmental aspect, what mechanism will ensure that cumulative or cross-boundary effects are sufficiently taken into account in planning decisions? For example, the cumulative impacts of new developments in different local authority areas on the demand for water, the management of waste, or on water and air quality will need to be addressed. Equally, a development in one area may have an impact on another, i.e. there are externalities for any development.

5.32 Externalities are likely to arise if the benefits of a decision are enjoyed by the local authority or community taking the decision, but its costs are borne by others. Externalities can be environmental, social or economic. For example, building on areas of nature conservation interest may have an impact on the national interest in biodiversity and the ecosystem services provided by that area, as well as having implications for the enjoyment of the land by those living outside the local area. The construction of housing in an area known to be at risk from flooding may create economic externalities, since the cost of protecting the inhabitants may ultimately be borne through the general tax system. Similarly, the higher per capita costs of connection to the mains water supply in the Highlands of Scotland are currently borne by people in the more densely populated central belt of Scotland. The mismatch between the location of housing and workplaces could create higher traffic densities and congestion, and hence both social and environmental externalities in the impact on air quality and amenity outside the area where the development takes place. From the opposite perspective, reluctance at the local level to accept development could have broader effects, for example, as to the availability of social housing.

5.33 Local planning decisions need also to take account of national policy objectives and targets. For example, there is a national, statutory target "to ensure that the net UK carbon account for the year 2050 is at least 80% lower than the 1990 baseline".[20] Individual decisions by local planning authorities, taken in aggregate, may help in delivering that target, or may make it more difficult. For example, we have described how in order to maintain the security of the supply of water in parts of London it has been necessary to build a desalination plant, which has a high energy demand when it operates (4.14).[21] If the cumulative effects of individual local decisions make it more likely that high energy solutions have to be adopted in order to meet demand, it will become more difficult to achieve the national target for carbon emissions. A different pattern of development, across a number of local authorities, to meet the demands of demographic change could on the other hand reduce the need for 'high energy' solutions.

5.34 There is also the question of the accountability of local authorities. Their primary accountability is of course to local electorates. The localism agenda is intended to build on that, and the Government is aiming to dismantle many of the systems of targets and reporting in line with that approach. But on some issues, local actions have implications for the whole country. As institutional arrangements change, existing mechanisms to ensure that local decision making is consistent with national policy objectives may be weakened or lost. The question then is: what, if anything, needs to be put in their place to ensure local decisions are compatible with national policy? For example, while local authorities may be required to report on climate change adaptation under the Climate Change Act 2008, it was decided that they need not do so because of their existing reporting obligations under National Indicator 188.[h] With the abolition of the Audit Commission, it will be important to revisit the question of whether local authorities should be regarded as priority reporting authorities under the Climate Change Act 2008.

5.35 Managing the impact of demographic change on the environment does not demand any particular institutional structure but does require some mechanisms for both considering issues at a scale beyond the local and ensuring that local decision-makers understand the environmental implications of demographic change. Some of those processes are in place, and later in this chapter we review the assessment processes which deal with environmental impacts.

5.36 There are already obligations for local authorities to co-operate and consider the impact outside of their own area. However, they are complicated and unclear, and may not be sufficient in the changed circumstances authorities now face. There needs to be more clarity about the importance of cross-authority consultation, and about the appropriate scale for assessment and for taking decisions.

5.37 The Secretary of State will maintain the right to 'call in' planning applications and to hear appeals against the refusal (although not the granting) of planning permissions. This maintains a national input into local development decisions. Major infrastructure planning will also still be carried out at the national level. Precisely how these central powers will relate to the new localism agenda remains to be seen.

5.38 The proposed new National Planning Framework, whilst intended to be more concise than current national planning policy (Planning Policy Guidance and Planning Policy Statements) means that national guidance will not disappear. It is not yet clear whether the Framework will have an explicit spatial dimension. And, for example, we have seen support from the Government for strong national policy to protect green belts.[22] It is important that whatever form it takes, national planning guidance continues to give sufficient weight to issues that reach far beyond the local level, such as the interactions between demographic change, biodiversity protection and climate change.

5.39 The move to abolish Regional Strategies (footnote vi to Box 5B) does not mean that the focus is solely on local intervention. For example, in England and Wales, the Environment Agency is responsible for overseeing the management of water resources, water quality, and flood and coastal risk across catchments. This role, and the River Basin Management Plans required under the Water Framework Directive, will continue to require work across local authorities.[23] Similarly, the Water Company Business Plans will continue to be produced with a long-term perspective and in a regional context.[24] Local Enterprise Partnerships, which will be created jointly by local authorities and businesses to drive forward economic development, including

h There is a fuller description of the system for reporting in 3.20-3.28 of our 28th Report, *Adapting Institutions to Climate Change*. Available at: http://www.rcep.org.uk.

through the provision of appropriate infrastructure, may also have the potential to provide co-ordination to ensure that coherent approaches are taken on those issues which need to be addressed at more than the local level.

5.40 In summary, as we have repeatedly pointed out, the spatial distribution of people is at least as important as total numbers. In other words, demographic change creates major issues for local governance. Hence, as power is expected to shift from the regional to the local level, questions remain about the specific types of incentive there will be for local authorities to work together to address cross-border issues and to take sufficient account of national objectives and targets, for example, on climate change mitigation and adaptation.

5.41 The Government must set out clear arrangements, and also provision in the national planning guidance, to ensure that local authorities work together when necessary to address issues of local and regional demographic change and the consequences for the environment. Government must also ensure that issues which are wider than local are given proper regard. There must also be proper accountability to ensure local decisions pay sufficient regard to the national interest. We make recommendations on these issues in Chapter 6.

The role of environmental assessments in planning

5.42 As we discussed in Chapter 4, addressing environmental constraints requires difficult judgements. The processes within which we make these judgements, particularly the spatial planning system, and the tools by which environmental impacts are identified and taken into account in this system are crucial.

5.43 A number of statutory provisions, derived from either domestic or European law, require environmental assessments to be made. In Box 5C we set out the basic elements of four key assessment processes: Strategic Environmental Assessment (SEA), Habitats Regulations Appropriate Assessment (HRA), Environmental Impact Assessment (EIA) and Sustainability Appraisal (SA). The first three are mandatory requirements of EU law, and so will continue irrespective of any changes to UK planning law; SA is a creature of domestic policy and legislation.

5.44 SEA plays an important role in the process of preparing spatial plans at national, regional and local levels. In England and Wales, there is a further requirement under the Planning and Compulsory Purchase Act 2004 for authorities to undertake a sustainability appraisal for Regional Spatial Plans and local development documents and plans, though clearly this requirement no longer applies to Regional Strategies.[25]

5.45 In our 23rd Report, *Environmental Planning*, we recommended that "the government, if it wishes to retain Sustainability Appraisal, should strengthen the environmental component so that it will satisfy the legal requirements of the [SEA Directive]". The report considered the alternative of recognising SEA "as the central requirement with a non-statutory supplementary exercise to take account of the economic and social dimension".[26] This is the approach currently followed in Scotland. In England and Wales, SA has acquired legal status and guidance is provided for incorporating SEA into the process.

BOX 5C ENVIRONMENTAL ASSESSMENT PROCESSES

Strategic Environmental Assessment (SEA)

The SEA Directive requires the environmental effects of a broad range of plans and programmes to be assessed early on in the development process so that they can be taken into account while the plans are being developed and adopted.[27] A consideration of 'reasonable' alternatives is a key element of the process. SEAs are applied more extensively in Scotland where they cover all public sector strategies, plans and programmes regardless of whether or not they are legally required or set a framework for future development consents. A Scottish review is underway which is seeking to evaluate the effectiveness of SEA as practised in Scotland.[i]

Habitats Regulations Appropriate Assessment (HRA)

An 'appropriate assessment' is required where a plan (including land use plans at the national or regional level) or project is likely to have a significant effect on a site protected under EU legislation.[28] If the HRA concludes there will be an adverse effect on the integrity of a site, the plan or project cannot be approved, unless there are no alternatives and it is done for "imperative reasons of overriding public interest", in which case compensatory measures must be taken.

The European SEA Directive expressly includes plans or programmes likely to have a significant effect on sites designated under the Habitats Directive (Natura 2000 sites). Accordingly, HRAs are carried out alongside SEAs where applicable.

Environmental Impact Assessment (EIA)

EIA applies to projects likely to have significant effects on the environment. Developers are required to compile an Environmental Statement (ES) describing the likely significant effects of the development on the environment and proposed mitigation measures. The ES must be circulated to statutory consultation bodies and made available to the public for comment. Its contents, together with any comments, must be taken into account by the competent authority, before it may grant consent.

Sustainability Appraisal (SA)

SA is a process incorporating SEA requirements alongside social and economic effects. SAs were required for Regional Spatial Strategies and local development documents in England and Local Development Plans in Wales.[29] Social and economic effects may be considered in Scottish SEAs but this is not mandatory.

5.46 The purpose of environmental assessment is to make sure the environmental consequences of land uses can be taken into account at the planning stage when it should be easier to address any concerns raised and mitigate potential impacts. It is important, therefore, that the scale of the assessment is relevant to the spatial impacts of the proposals.

5.47 We were told that strategic assessments (SEA or SA) have considerable potential for improving the quality of spatial plans with respect to identifying potential environmental impacts and considering how to address these. We have seen some very good examples of SAs, with scrupulous analysis

i The review is being led by the Scottish Environment Protection Agency (SEPA) and will report in mid-2011. Details can be accessed via the following link: www.scotland.gov.uk/Topics/Environment/SustainableDevelopment/14587/Review.

of a full range of environmental issues in the appropriate level of detail. It was pointed out to the Commission that the SA element of the Regional Strategies had encouraged a transparent consideration of the balance of social, economic and environmental issues.[30] In the last of the Strategies to have been examined (West Midlands Phase 2 Panel Report) environmental issues exerted a broadly downward pressure on the overall housing total and had a strong influence on the spatial distribution of housing allocations at the sub-regional level.[31]

5.48 The SA of the London Plan also illustrates the value of assessments.[32] It pointed out the challenging nature of the commitments on water supply and quality, waste management, biodiversity and carbon mitigation. In particular, the report drew attention to the continuing poor air quality caused by vehicle emissions and aviation.

5.49 We are aware, however, that the SEA process is not always as satisfactory as it might be. The quality of any environmental assessment is dependent on the quality of the data on which it is based. Acquiring and analysing such data for an SEA or SA can be costly and time-consuming because of the potential scope of the strategic plans. If an environmental report is not pitched at the right level and contains too much detail, it will not provide the basis for a meaningful assessment. If this happens, there is a danger that the SEA could come to be regarded as merely a bureaucratic hurdle.

5.50 At their best, SEAs seek to identify constraints associated with types of activities and place these in the context of environmental constraints that would affect particular types of development. There may be an unrealistic expectation of what a strategic assessment, be it an SEA, SA or HRA, can achieve. Their strategic nature means they are not likely to provide the information needed for detailed decision making, nor are they intended to do so. An area zoned for industrial development, for example, may give rise to issues of air quality, water quality or habitat impact, but until details of the type of industry are known, the environmental impacts are largely a matter of speculation.

5.51 SEA and EIA do not contain substantive environmental requirements, but are a tool to ensure that environmental considerations are properly assessed and then taken into account in decision making. In our discussion of environmental constraints in the previous chapter, we made the point that there can be a strong element of value judgement in applying legal standards. The same is true for SEAs. Whereas consent for development may be conditional on mitigating environmental impacts, there is no requirement to refuse a planning application because of an unfavourable EIA. Assessment under the Habitats Regulations is different in one important respect. If the HRA does not conclude that there will be no adverse effect on the integrity of a site, a plan can only be approved if there are no alternatives and the plan is put in place for imperative reasons of overriding public importance.

5.52 The UK Environmental Law Association told us of concerns over the relationship between strategic HRA and a subsequent HRA at the project level, because of the danger of relying on data amassed for an assessment made many years before the project is ready for development.[33] This means it is important to regard assessment as an ongoing process incorporating monitoring and review.

5.53 As experience of SEAs increases and good practice is established, there has been a growing awareness of the need for iteration and reiteration at each stage of the plan's development and revision. We conclude that environmental assessment at the strategic level should be an important part of medium- to long-term planning whether plans are being considered at national, regional or local level.

Conclusion

5.54 From this analysis, it is clear that there are a number of instruments open to government (both central and local) to ensure that the environmental implications of demographic change, and in particular the spatial dimension of demographic change, can be identified. Economic policies offer the prospect of influencing demographic change directly, by seeking to prevent or reduce migration away from less prosperous areas, and hence limit development in those areas facing more pressure.

5.55 We conclude from the discussion in this chapter that the spatial planning system is profoundly important in the management of the environmental impacts of demographic change. The system, in England at least, is undergoing major reform. Adequate mechanisms to ensure that the environmental implications of demographic change are assessed must be retained, and in some cases developed. There will inevitably be issues that cannot be adequately addressed at a purely local level and it is unlikely that these issues will be fully dealt with at the national level. Given the probable gap between the national and local, processes to ensure that local planning authorities can be held to account beyond as well as within their borders are crucial. We will make a number of recommendations to address this point in Chapter 6.

Chapter 6

What should be done?

6.1 During the course of this study, the Commission has identified a real need for a more open and rational discussion about demographic change, and in particular the environmental impacts of demographic change. We hope that this report will provide a basis for starting that discussion within Government and beyond, and welcome the fact that other studies are also now beginning to examine these issues.[a] In addition, we set out in this chapter a small number of clear and relevant policy recommendations about the impacts of demographic change on the environment.

6.2 The UK will face a complex pattern of demographic change over coming years, and this will have environmental impacts which need to be assessed and managed. The total population is likely to continue to grow, at a historically relatively high rate. A key component of this increase will be due to the continuing increase in lifespans, so the average age of the population will increase, and the number of older people will grow and comprise a greater proportion of the population. The current indication is that there will continue to be net inward migration, the magnitude of which will be largely influenced by economic factors. The number of households is projected to grow much more rapidly than the population as more people live alone or in smaller households. Some places will see pressure for greater than average growth, while in others populations may decline.

6.3 Critically for the foreseeable future, the environmental impact of a changing population depends on a good deal more than just the number of people in the UK: patterns of consumption and where people live are more important factors in determining environmental impacts than how many of us there are in aggregate. Choices about behaviour and consumption, reflected, for example, in the amount of energy and water used in homes, the amount and patterns of waste generated, and the amount people travel, have a very significant effect on the environmental impact of each person. As people have become steadily more affluent, consumption has tended to increase substantially. National income has more than doubled in the last forty years, while the population has grown by only 10% (3.10).

6.4 As a result of innovation, tighter regulation, and very significant investment in better technology, it has been possible to offset a significant part of the impact which a growing population and the much greater increase in affluence would have otherwise caused. It has been possible to achieve improvements in a number of environmental indicators such as air and water quality over recent years, despite an increase in population (3.25-3.27; 3.32-3.37). Considerable investment has been made to secure those improvements. But even so, only 26% of rivers in England and Wales are currently assessed as being of 'good' status under the Water Framework Directive classification, and there are several UK urban areas which are not yet in compliance with air quality directives. Further investment will be needed to cope even with current pressures.

6.5 Population growth will continue, and the economy will grow. In some parts of the country, the demand for new development to accommodate this growth will increasingly come up against environmental constraints (4.26-4.36). These constraints may not necessarily be a bar on new development, but it will be costly (in terms of money, and in some cases also energy) to manage

a Current work includes a Royal Society study on *People and the Planet: The role of global population in sustainable development,* and the Government Office for Science Foresight project on *Global Environmental Migration*.

them. For example, a significant element of the £22 billion capital investment planned by water companies between 2010 to 2015 will be to connect nearly one million additional properties to the water supply and sewerage service.[1]

6.6 The pressures on the environment will therefore grow. It is clear to the Commission that there has been inadequate focus within Government on the implications of demographic change for the environment, and on the cost of managing those implications. Unless these issues are addressed urgently, there is substantial risk of costly problems emerging in future.

6.7 What should be done? Should the Government seek to influence demographic changes in the UK, or is it generally more appropriate to seek to mitigate the potential environmental impacts of those changes?

Limiting the growth in the aggregate population?

6.8 The Commission received some representations suggesting that it would be possible to set a figure for a sustainable population for the UK, based on environmental limits, and contending that it is in the national interest to stabilise the population by non-coercive means as soon as possible. In particular, the Commission received a suggestion that less than 30 million might be a 'sustainable population' for the UK[2] – in other words, about half the current population. We accept the contention that few environmental problems are made easier by having a larger population, but the Commission does not accept that this suggestion is a good basis for policy, for a number of reasons.

6.9 There are in practice no policy options open to Government in a democracy which would have a significant impact on the size of the population of the UK on a relevant timescale. As explained in Chapter 2, the Office for National Statistics (ONS) produces a number of variant population projections based on alternative assumptions about fertility, longevity and migration. Figure 2-VII set out these projections, looking ahead 75 years. They suggest that even if it were possible to devise socially acceptable means of constraining population growth, they would take effect slowly and population would almost certainly rise for some time before it could start to decline. Any attempt to implement a 'population policy' would therefore have little impact on the total population, and the objections on social and ethical grounds would outweigh the environmental gains.

6.10 Rates of growth in aggregate population have historically been closely related to UK economic performance. Higher rates of GDP growth have been associated with relatively high rates of net in-migration, and when economic performance has been poor (as in the recession of 1991) there has been net out-migration. The implication is that the rate of future population growth will depend to a large extent on future economic performance. This is not well reflected either in current political debates about future population size or in the methods currently used to project future population. The Government has already adopted more stringent controls on immigration from outside the EU, and we do not consider that there is a case for further controls to regulate non-EU migration on environmental grounds.

6.11 As we noted in Chapter 3, environmental impacts are conceptually related to three factors – the number of people, the amount each of them consumes, and the impact associated with creating each unit of consumption. There is no optimum level of any one component, and it is the combination of the factors which determines the environmental outcome.

6.12 We therefore believe that to minimise environmental impact the focus of policy which directly engages with demographic trends should be to address how and where the growing population lives. We return to this later in the chapter.

The changing age structure

6.13 The increase in life expectancy, an important driver contributing to an increasing population, and the consequent growth in the number of older people are likely to continue within the timescale of this study, as a result of further improvements in public health and medical science.

6.14 It is important that Government and service providers should plan for this demographic trend, not only to prepare for the significant social and economic issues which will arise (and which are beyond the scope of our report) but also to mitigate the potential environmental impacts. As people have more years of active life, they will potentially have a greater environmental impact – and we have seen in Chapter 3 that those in later working life and early retirement may well have the greatest per capita carbon footprint (3.39-3.40).

6.15 Older people, and particularly those over 75, on average contribute disproportionately to carbon emissions from heating their homes, because they spend a greater amount of time at home and feel the cold more intensely (Figure 3-IX). This suggests that programmes to improve energy efficiency should concentrate particularly on the homes of older people. There is also a growing issue about the potential environmental impact of pharmaceuticals released into the environment by excretion or disposal (3.45-3.46), particularly by the elderly who use more medicines than younger people; we are pleased that the Advisory Committee on Hazardous Substance has decided to discuss this issue further.

6.16 The environmental consequences of these changes are well understood in some cases (e.g. household energy use). However, in other areas more research into the potential environmental impacts is urgently required, for example, those arising from the greater use of pharmaceutical products, and from the changing patterns of demand for transport or for open space for leisure. **The Commission recommends that Government and the Research Councils commission research to understand better the environmental consequences of increasing longevity**.

Growth in the number of households

6.17 The number of households is projected to grow much faster than the population. In England, for example, while the population is projected to grow by 18% over the next 25 years,[3] the number of households is projected to grow by 29% as the average household size continues to fall.[4,b] The need for new housing which flows from the growth in the number of households, and the distribution of this demand in relation to the capacity of different areas to accommodate development in the light of environmental constraints, has been a central issue in regional planning. It will continue to be an issue as the new localism agenda is implemented by the current Government. Growth in the number of households is closely related to the issue of regional distribution of the population.

b The Office for National Statistics population projection figure is estimated to 2033 from a baseline of 2008, whereas the Department for Communities and local Government household projection is to 2031 from the 2006 estimate.

6.18 The growth in the number of households reflects both the growth in the total population, and people's circumstances and choices (for example, the stage of their life, their marital or partnership status, whether they have dependent children, and divorce and bereavement). Again, most of these are only marginally influenced by policy levers such as tax incentives, property taxation or benefit rules. Social policy considerations have probably been the primary factor in framing these regimes, but they may also have environmental impacts, and these should not be overlooked.

6.19 However, given the level of demand for housing, it will be important to seek to meet that demand in ways which minimise the environmental impact. In the next section we consider the issues associated with managing the spatial distribution and the location of development through the planning system, but it is also important that new housing is well designed and managed so as to reduce environmental impacts, through water and energy use for example. Planning guidance and building regulation have an important role to play. The Commission dealt extensively with these issues in its 26th Report, *The Urban Environment*.[5]

The spatial distribution of population

6.20 We emphasised in Chapter 4 that the distribution of the pressures arising from demographic change are not uniformly distributed across the UK – indeed, they are often extremely 'grainy', with some areas facing intense pressures for growth while others are dealing with the issue of depopulation, on a variety of spatial scales. Coupled with the fact that environmental constraints are different in different parts of the UK, the spatial aspect of demographic change is crucial. We described in Chapter 5 the spatial planning system, and the evaluation techniques applied to decisions taken through that system. In England (outside London), the spatial planning system is currently undergoing reform which will change the way in which the demand for new housing and the associated infrastructure, for example, will be managed.

6.21 Those making decisions need to understand clearly the environmental constraints which apply in different areas, and the ways in which new development may relate to those constraints. But, as we made clear in Chapter 4 (4.26-4.36), constraints are often not absolute. Rather, the issues are about costs and priorities. There needs to be informed debate about the impacts of population growth and distribution, and about the choices which have to be made when deciding on the types and location of development.

6.22 The Government is placing localism at the heart of the planning system. Strong local engagement and control over development decisions is to be welcomed. But it should also be recognised that there are some issues which will require consideration over a wider area than that of an individual local authority if appropriate decisions are to be made. For example, the potential impacts of some development may extend over an area far greater than that of a local planning authority. **The Commission recommends that Government ensure that the National Planning Framework requires local planning authorities to work with each other to address the cumulative and cross-boundary environmental implications of development.**

6.23 Equally, local decisions will need to be consistent with national objectives. It remains to be seen whether or not the proposed consolidated national planning guidance, and the proposals to create financial and other incentives for local communities to accept development, will be sufficient to ensure that regional and national needs are adequately reflected. Moreover, decisions on new developments should take account of the national target to reduce greenhouse gas emissions by

80% by 2050 (from 1990 levels).[6] This may be a particular issue, for example, where a development (or possibly cumulative developments in several areas) implies a need for energy-intensive drinking water treatment (such as desalination) to ensure supply or for sewage treatment.

6.24 There need to be mechanisms, therefore, to ensure that local planning authorities can be held to account where necessary, particularly as some of the previous reporting mechanisms will no longer be in place. **The Commission recommends that Government ensure that the National Planning Framework requires local authorities to take account of the implications of their decisions for the achievement of national environmental policy targets.** It will be important to ensure that local planning authorities can be held accountable for making decisions which are consistent with national environmental policies and targets.

Environmental assessments

6.25 The various assessments of Regional Strategies required under EU and national legislation have not always ensured that environmental constraints have been taken into account. They were successful, however, in ensuring that the key environmental issues were comprehensively and publicly identified, and there were signs that with each iteration of the Regional Strategy they were having a greater influence. In the absence of Regional Spatial Strategies, there may now be fewer opportunities for the analysis and informed debate that was part of their development.

6.26 In the previous chapter we emphasised the need for Strategic Environmental Assessments (SEAs) to be carried out at the right scale, and at an appropriate (and not excessive) level of detail, as well as the need for assessments to be regarded as living documents, which evolve with plans or projects and in response to new data and evidence, rather than a static bureaucratic hurdle. **The Commission recommends that Government review environmental assessment guidance and requirements to ensure that development and spatial planning is appropriately informed by assessments at the right spatial and temporal scale to reflect the social, economic and environmental impacts of demographic change.**

6.27 The process for preparing Regional Strategies required the assembly and analysis of a great deal of information and data both on demography and on the environment. These resources must be maintained. In a system without Regional Strategies, there will still be value in some analysis at the regional level. **The Commission recommends that Government ensure existing regional data sets are protected and made available, and that they continue to be developed to meet the needs of new administrative structures.** For example, these data should be made available to nascent Local Enterprise Partnerships and local authorities to inform their planning work.

6.28 Some of the greatest pressures on the UK environment are in London and the south-east, where environmental constraints may lead to significant costs in accommodating development. We welcome the recognition by the Prime Minister that the economy is too reliant on a few regions (5.14).

6.29 We received some fragmentary evidence on the costs of accommodating higher population levels in areas of significant environmental constraint (4.12) but there is, to our knowledge, no systematic attempt to estimate the aggregate costs of accommodating environmental constraints in areas of demographic pressure, especially the south-east of England. Equally, there is very little contemporary analysis or data on the costs of policies designed to influence population distri-

bution so as to avoid some of these environmental constraints. **The Commission recommends that Government commission research to understand the relative costs (environmental, social and economic) of accommodating development in areas facing environmental constraints and of economic development incentives designed to encourage development in areas facing fewer environmental constraints.**

6.30 Such research needs to consider the cost-effectiveness of a range of different approaches, especially in the case of economic development incentives, where a range of different instruments are possible from administrative control to various financial incentives. Without knowledge of the balance between the costs of these two alternative policy approaches to environmental pressures, it is difficult to see how Government can take economically rational and environmentally sound decisions on future policy directions.

Understanding demographic trends

6.31 Future population projections play a key role in debates about demography and environmental impact. Current methods project forward on the basis of past trends and a series of assumptions about the future. We welcome the commitment by the ONS to develop more sophisticated methods of forecasting future population (2.14). It will be particularly important to have a better understanding of likely demographic change at the local level, to address some of the concerns which were expressed to us, and in the light of the importance of the distribution of the population rather than just the total size. It is also important that the uncertainties inherent in population projections are properly understood by the users of those projections. There is a broad analogy with climate change, where the development of models of future climate recognise the inherent uncertainties and provide information at appropriate spatial scales to support policy decisions.[c] **The Commission recommends that the Office for National Statistics include in its programme for the development of population projections more sophisticated methodologies for forecasting populations at more local levels. These methodologies should also reflect more fully the uncertainties inherent in the forecasts.**

6.32 While demographic change is only one of a number of factors which policy- and decision-makers need to take into account when planning for an uncertain future, it would be beneficial for the likely trends to be better appreciated and the implications understood outside the circle of those who are demographers. Again, there is a broad analogy with climate change, where a better appreciation of the implications for the projections is the first step towards developing robust adaptation strategies. **The Commission recommends that the UK Government and the Devolved Administrations ensure as a matter of urgency that the environmental impacts of demographic trends be taken fully into account in developing policies and programmes at national and local levels. We recommend Government identify a lead department, for example, the Department for Environment, Food and Rural Affairs (Defra) or the Cabinet Office in England, to be responsible for this.**

Reducing the environmental impact of consumption

6.33 The Commission has found that there are no simple or universal relationships between population numbers, consumption patterns and the resulting environmental impacts. It is clear that reducing or stabilising population overall does not offer a simple solution to future environmental challenges:

c We described these projections in Chapter 2 of our 28th Report, *Adapting Institutions to Climate Change*. Available at: http://www.rcep.org.uk.

the more closely we examined the problem, the more difficult it became for us to disentangle the constraints imposed by nature, the choices people make in response to life events, and the interactions between these constraints and choices. If the issue of the sustainability of the UK population is to be addressed the answer must lie largely in measures that address the impact of consumption – both in terms of the consumption patterns determined by affluence and progress in technology and environmental standards.

6.34 It will clearly not be easy to reduce the environmental footprint per person in the UK, and will require sustained efforts using all available techniques, including regulation, incentives, education and persuasion, and the continued development and application of better technology.

6.35 There is also a role for regulation to drive further investment in reducing environmental impacts. The EU and the Government have, for example, introduced rules to drive up the energy efficiency of domestic goods and of cars. Often consumers may not notice the change – they may not be aware that many domestic appliances with low energy efficiency have been withdrawn from the market – while in other cases (e.g. incandescent light bulbs) there may be some adverse consumer reaction to the change. Consumers may also not be aware that a proportion of the electricity they consume has come from renewable sources (though some do specifically opt for suppliers offering green tariffs). These sorts of changes allow consumers to maintain their lifestyles, while forcing a reduction in their environmental impact by regulation.

6.36 Other approaches use fiscal incentives (e.g. the landfill tax or petroleum duty) or charging regimes to influence behaviour, so that consumers or businesses are forced to bear some of the environmental costs. The extent to which these approaches are effective depends on how consumers respond to changes in prices and may be less than hoped for. For instance, evidence about the demand for electricity in Northern Ireland suggests that a modest increase in price has only a very limited effect in reducing consumption.[7]

6.37 Water metering demonstrates a move both to introduce a financial incentive to reduce demand and to increase awareness of consumers about how much water is being used. Labelling of products to highlight environmental impacts (for example, the embedded carbon footprint or the energy consumption) provides another way of both encouraging and making it possible for consumers to reduce their environmental impact.

6.38 Improvements in technology will continue. Indeed, if the target of reducing greenhouse gas emissions by 80% is to be achieved by 2050, which will require a 'carbon intensity' of only one tenth of current levels, new technologies, including energy generation from non-fossil fuels and more energy-efficient goods and services, are essential.

6.39 Government has invested considerable amounts in seeking to promote more sustainable patterns of consumption and behaviour. We noted the extensive work which Defra, for example, has been doing to understand the motivations of different groups of the population according to their attitudes, aspirations and world views in order to identify the most appropriate way of communicating information and promoting sustainable behaviour ('customer segmentation'). We also noted the academic research which, in the context of climate change, identified a number of perceived barriers which may limit people's engagement with the issue.[8] The individual barriers can include a lack of knowledge, scepticism, a distrust of information, externalisation of responsibility, a belief that technology will solve the problem, a belief that the threat is distant, a low priority compared with other pressing priorities, a reluctance to change behaviours, fatalism, and feeling that an individual action is but a drop in the ocean and therefore pointless.

6.40 Government targets are focusing on reduction in resource use including cutting carbon emissions; the ambition to reduce average per person water consumption in England and Wales from 150 litres per day in 2008 to 130 litres per day by 2030; goals for 2014-20 to set a path towards a zero waste economy in England, to be published by May 2011;[9] and the '*One Wales, One Planet*' policy adopted by the Welsh Assembly Government.[10] Nevertheless, it seems clear that progress so far does not give confidence that ambitious targets will easily be achieved. **The Commission recommends a step change in Government efforts to increase resource use efficiency, so as to radically decouple consumption from environmental impacts. This the Commission regards as a matter of urgency.**

Conclusion

6.41 The 1973 Population Panel looked to the newly-formed Royal Commission on Environmental Pollution to address in more detail the environmental issues arising from the growing population. Although many of our earlier reports have dealt with some aspects of this indirectly, it is only in what has turned out to be our final report that we have dealt with demographic change as an issue in its own right.

6.42 What is most important is that the nature and implications of all the aspects of demographic change considered in this report are better understood, and that they are recognised as a significant factor in determining the environmental impact of the UK population. A combination of better technology, of planning and other policies which seek to minimise and manage environmental impacts, as well as changes in consumption patterns, offer a greater scope to achieve sustainability than policies directed at influencing the size of the UK population.

6.43 The increase in the aggregate population is only one aspect of demographic change. Policy-makers and service providers need to take account of aspects such as longer lifespan and the growing number of older people, the patterns of regional migration and the increase in the number of households. Our view is that the differential pressures in different parts of the UK, often down to a very local level, are more significant for the environment than the growth of the total population.

6.44 In summary, it is not the total size of the UK population which is the problem: it is how and where people choose to live which presents the main environmental challenge from demographic change. Addressing these challenges will not be easy – it will require sustained political will, societal change and technological innovations. Above all, it will require sustained efforts by Government to understand, communicate and implement the measures needed to reduce the environmental impacts of the population of the UK.

All of which we humbly submit for Your Majesty's Gracious Consideration

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Jonathon Ayres

Michael Depledge

Maria Lee

Peter Liss

Gordon Mackerron

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Judith Petts

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Appendix A

Conduct of the study

An overview of the conduct of the Demographic Change and the Environment study is provided in this appendix. Detailed information regarding the conduct of the study is available on the Commission's website, http://www.rcep.org.uk, including evidence submitted to the study, reports of visits and workshops, and commissioned reports.

A1 Announcement of the study

The Royal Commission study on Demographic Change and the Environment was announced on 19 March 2009.

The Commission chose to study this topic because it believed that demographic change is likely to have important environmental consequences and that these need to be carefully considered against the background of additional pressures due to climate change. Although there may be an increasing understanding of the way the UK population is changing – and much thought is already being given to the social and economic implications of these changes – it seemed that little attention had so far been paid to the environmental consequences or to the effect on the environment of demographic change within the UK. The Commission considered this to be an area in which it could make a useful and timely contribution without duplicating any work already being carried out by others.

In order to carry out the study the Commission sought written and oral evidence, commissioned studies, took advice on specific topics, and made a number of visits. The Commission also hosted two workshops in support of the study, to discuss the wide-ranging impacts of demographic change on the environment.

A2 Scoping phase

The Commission was interested in looking at the two-way interactions between environment and population so, as well as considering which aspects of demographic change were likely to have the most significant impact on the environment and what might be done to respond to them, it also wished to consider reciprocal effects, such as, for example, how environmental change might affect population movements. On the basis of the comments already sent to the Commission, the initial view was that the following broad themes might be among those covered by the study:

- Direct impacts such as overall population size, household numbers;
- Changes in age, ethnicity and spatial distributions;
- Family and household structures;
- Population movements within the UK;
- Population pressures on the land, e.g. for housing, food production, recreational space, transport, energy and water requirements, waste disposal;

- Indirect impacts, e.g. on the views and behaviours of different groups, which may in turn have environmental implications; and
- The effects of environmental change on population movements, e.g. moving away from flood-risk areas.

This list was not intended to be comprehensive or definitive: the Commission welcomed views on these themes, and thoughts on what environmental impacts might give rise to particular concern. In this first phase, the Commission sought to gain an overview of current thinking, to gather sufficient background information to enable the Commission to decide how best to approach the topic, to consider which aspects were most likely to benefit from investigation, and in what way the report might be most valuable.

A3 Evidence gathering

The initial comments we received underlined the importance and timeliness of the topic, and illustrated how complex and wide-ranging the study could become. The Commission therefore considered it essential to be very clear about the areas in which it could most usefully offer recommendations, and decided to collect evidence for the study in two stages.

First stage evidence

As part of the first stage collection of evidence, the Commission invited organisations and individuals to submit factual information about various aspects of demographic change and its potential environmental impacts in the UK (in the timescale to 2050).

This was to enable the Commission to gain a broad understanding of the key issues, trends and impacts before reaching a decision on the specific questions to be investigated in more detail at the second stage.

The Commission's initial view was that the following were the areas most likely to be significantly affected:

- Water use and quality
- Energy use and climate
- Air quality
- Food and waste
- Landscape and land use
- Biodiversity.

Organisations were asked to provide factual information and comments with regard to the trends and impacts listed above. Questions posed included:

- What information is currently available and what this tells us about these trends and their drivers;
- Whether trends are locked in or are likely to change in the period to 2050;
- What we already know about the likely impacts of these trends on those aspects of the environment identified above;
- What projections of water and energy consumption, waste production and greenhouse gas emissions have been produced for different population trends; and

- What steps, if any, are being taken to prepare for the changes.

Over 20 submissions of first stage evidence were received by the Commission by the deadline of 6 November 2009. This evidence was used to develop a set of more detailed questions on which to request formal evidence for the second phase of the study.

Second stage evidence

After the first stage of evidence gathering, the Commission identified a number of specific trends with the potential to have a significant impact on the UK environment. These were:

- Projected increases in the total population;
- The changing age structure of the population;
- Changes in household size and composition;
- The distribution of population between urban and rural areas; and
- The regional distribution of population and the regional variation in population change.

The Commission was particularly interested in the effect of these demographic trends on water use, energy consumption (and greenhouse gas emissions), waste generation, landscape and biodiversity in different parts of the UK.

We addressed specific queries directly to those whom we considered most likely to have the most relevant detailed information, including;

- Energy companies
- Water companies
- Waste disposal authorities and other waste bodies
- Government departments
- Local authorities, Regional Offices, regional partnerships and development bodies
- Devolved Administrations.

Other organisations and individuals were invited to respond to a set of more general questions. The deadline for responses was Friday 9 April 2010. Over 30 submissions of second stage evidence were received.

A4 Reports, visits and workshops informing the study

Commissioned reports

A paper on *'Regional Policy and Migration in the UK'* was commissioned from Professor Steve Fothergill, Centre for Regional Economic and Social Research, Sheffield Hallam University.

A paper on *'Pharmaceutical products in the environment in the context of demographic change in the UK'* was presented by Ruth Willis, an Economic and Social Research Council (ESRC) sponsored internship student at the Commission from February to April 2010.

Visits and workshops

Several workshops and visits were undertaken to inform the study. Brief reports of these events are provided below. Full details are available on the Commission's website at http://www.rcep.org.uk.

July 2009, Oxford International Migration Institute, University of Oxford

Members met representatives from the International Migration Institute and the Centre on Migration, Policy and Society to develop their understanding of migration issues, and are grateful to Professor Stephen Castles, Professor Michael Keith and Ms Gunvor Jónsson for providing valuable information.

March 2010, Lincolnshire

Members made a two-day visit to Lincolnshire during the second stage of the study. The Commission visited Lincolnshire to hear more about the trends described in the Lincolnshire Research Observatory study and their potential environmental impacts in the area.

During the visit, the Commission heard presentations from officers at Lincolnshire County Council and discussed a range of issues with them and others, including Councillor Eddy Poll and representatives of Lincoln City Council, the Environment Agency, the Commission for Rural Communities, Boston Borough Council and the Boston Citizens Advice Bureau. The Commission is grateful to all those who took part in the visit and is particularly indebted to Richard Wills and Becky Robinson-Foottit of Lincolnshire County Council for handling the detailed arrangements.

April 2010, Inverness and Perth

The visit was arranged in response to the Commission's desire to learn more about the environmental impacts of areas with high intra-regional variations in population, and with areas of population decline alongside settlements with rapidly expanding populations.

Members began their three-day visit in Inverness with discussions with representatives from the Highland Council, the University of the Highlands and Islands, and Scottish Natural Heritage (SNH). A full programme of presentations and discussions was then kindly hosted by SNH, where Members were joined by representatives from Highlands and Islands Enterprise, Scottish Water, The Highlands and Islands Strategic Transport Partnership, Caledonian Environment Centre, Comhairle nan Eilean Siar (Western Isles Council), Scottish Environment Protection Agency, and the Macaulay Land Use Research Institute. The visit concluded with a visit to Perth where discussions were held with officials from Scottish Enterprise, Perth and Kinross Council, Scottish Agricultural College, Ramblers Scotland and the Royal Society for the Protection of Birds. The Commission is very grateful to all those who contributed to the visit and would particularly like to thank Bill Band of SNH for handling the detailed arrangements and for offering the use of SNH's excellent facilities.

May 2010, Newcastle

Members and Secretariat made a one-day visit to Newcastle during the second stage of the Commission's study.

The Commission decided to visit Newcastle, specifically to hear more about the work being taken forward on ageing at the Institute for Ageing and Health, also to visit the Centre for Urban and Regional Development Studies at Newcastle University and, more generally, to find out more from One North East about an English region with different characteristics to the sites already visited. The Commission is very grateful to all those who organised and took part in the visit.

June 2010, Cardiff and the Heads of the Valleys, Wales

Members and Secretariat were grateful to Jane Davidson AM, Minister for Environment, Sustainability and Housing in the Welsh Assembly Government, who met the Commission, and gave an update regarding recent developments in Wales.

The Commission also made a visit to see regeneration at the site of the former Ebbw Vale steel works, known as 'The Works', in the Heads of the Valleys area in South Wales. There, the Commission received presentations about the Heads of the Valleys regeneration partnership and about the Welsh Assembly Government's programme to promote energy efficiency. The Commission also enjoyed an informative tour of The Works site, and would particularly like to thank Chris Ashman and colleagues for arranging the visit.

Workshop in London: Demographic change in the UK

On 20 January 2010, the Commission hosted a workshop at Goodenough College, London, to bring together a number of experts in areas relevant to the study on the environmental impacts of demographic change in the UK. The aim of the day was to explore some of the issues raised in responses to the preliminary call for evidence, and also to identify areas in which the Commission could invite further submissions through a subsequent, second call for evidence.

In addition to Members and Secretariat, participants of the workshop included:

- Andrew Baker, Natural England
- Dr Laura Bellingan, Society of Biology
- Richard Cooper, Nottinghamshire County Council
- David Greenfield, Improvement and Efficiency South East
- Judith Hanna, Natural England
- Bruce Horton, Water UK
- Andy Howe, Environment Agency
- Fiona Howie, Campaign to Protect Rural England
- Dr Meg Huby, University of York
- Clare Jenkinson, Forum for the Future
- Phil Lawton, National Grid
- Steve Lees, Chartered Institution of Wastes Management
- Nicola Lloyd, Commission for Rural Communities
- Anne Owen, Stockholm Environment Institute
- David Payne, South East England Development Agency
- Trevor Payne, University College Hospital, London
- Professor Mark Tewdwr-Jones, Bartlett School of Planning / Foresight Project

Workshop in London: The environmental impacts of demographic change in the UK. The South East environment (including London)

On 5 May 2010, the Commission hosted a workshop at the Coin Street Neighbourhood Centre, London to discuss the environmental impacts of demographic change in the context of the South East Region of England (including London).

The workshop was held to bring together a number of individuals with expertise in dealing with relevant issues in the South East Region and London, and to explore in more detail some of the issues raised in the call for evidence. Participants included representatives from the Greater London Authority and other local and regional authorities, from the Environment Agency, from the water and energy industry sectors, and other non-governmental organisations and experts.

In addition to Members of the Commission and Secretariat, participants included:

- John Coleman, Commission for Rural Communities
- Mark Dickinson, Thames Water
- Dr Tony Hargreaves, University of Cambridge / SOLUTIONS Project
- Richard Hatch, Environment Agency
- John Hollis, Greater London Authority
- Chris Kneale, Southern Water Services
- Richard Linton, Greater London Authority
- David Payne, South East England Development Agency
- Andy Richmond, Greater London Authority
- Mike Smith, Utilicom
- Tim Stansfeld, South East England Development Agency
- Riki Therivel, Levett-Therivel
- David Todd, Thames Water

A5 List of contributors to the study

The organisations and individuals listed below either submitted evidence or provided information on request for the purposes of the study, or otherwise gave assistance. In some cases (indicated by an asterisk), meetings were held with Commission Members or the Secretariat in order to discuss particular issues.

The Commission are grateful to all organisations and individuals for their valuable contributions to this study.

Government departments

- Department for Communities and Local Government (CLG)
- Department for Environment, Food and Rural Affairs (Defra) *
- Department for Transport (DfT)
- Department for Work and Pensions (DWP) *

- Department of Energy and Climate Change (DECC)
- Foresight (Government Office for Science, Department for Business, Innovation and Skills (BIS))
- Office for National Statistics (ONS)

Devolved Administrations

- Department for Regional Development, Northern Ireland (DRDNI)
- Department of Agriculture and Rural Development, Northern Ireland (DARDNI)
- Department of Enterprise, Trade and Investment, Northern Ireland (DETINI)
- Department of Environment, Northern Ireland (DOENI)
- Scottish Government
- Welsh Assembly Government

European and international bodies

- European Commission – Environment Directorate General: Unit of the Chief Economist, Instruments, and Impact Assessment
- European Commission – Health and Consumers Directorate General
- European Commission – Research Directorate General

Other organisations

- All Party Parliamentary Group on Population, Development and Reproductive Health
- Boston Borough Council *
- Boston Citizens Advice Bureau *
- Bristol Water
- British Society for Population Studies (Individual Responses)
- Caledonian Environment Centre *
- Campaign for Clean Air in London
- Campaign to Protect Rural England (CPRE)
- Chartered Institution of Water and Environmental Management
- Climate South East
- Comhairle nan Eilean Siar (Western Isles Council) *
- Commission for Architecture and the Built Environment (CABE)
- Commission for Rural Communities *
- Countryside Council for Wales (CCW)
- Cross Party Group on Balanced Migration
- Devon Conservation Forum
- East Midlands Development Agency
- Environment Agency (EA)
- Essex and Suffolk Water

- Forum for the Future *
- General Register Office for Scotland (GROS)
- Good Energy
- Heads of the Valley Programme (Rhondda Cynon Taf, Merthyr Tydfil, Caerphilly, Blaenau-Gwent and Torfaen Authorities) *
- Highlands Council *
- Highlands and Islands Enterprise *
- Highlands and Islands Transport Partnership (HITRANS) *
- Institute for Public Policy Research (IPPR)
- Lincoln City Council *
- Lincolnshire County Council *
- Lincolnshire Research Observatory (LRO) *
- Local Government Association
- London School of Hygiene and Tropical Medicine (LSHTM) *
- Macaulay Land Use Research Institute
- National Housing and Planning Advisory Unit (NHPAU)
- Natural England
- Newcastle University: Institute for Ageing and Health, Centre for Urban and Regional Development Studies
- Northern Ireland Environment Agency
- One North East *
- Optimum Population Trust (OPT)
- Parliamentary Office of Science and Technology (POST)
- Perth and Kinross Council *
- Portsmouth Water
- Ramblers Scotland *
- Research Councils UK (RCUK)
- Royal College of Physicians
- Royal Society for the Protection of Birds (RSPB) *
- RWE npower
- Scottish Agricultural College *
- Scottish Enterprise *
- Scottish Environment Protection Agency (SEPA)
- Scottish Natural Heritage
- Scottish Water *
- Southern Water Services

- Stockholm Environment Institute
- Surrey County Council (Surrey Infrastructure Capacity Project) *
- Thames Water *
- 'The Works' Ebbw Vale *
- Town and Country Planning Association (TCPA) *
- University of Oxford: Centre on Migration, Policy and Society (COMPAS), Refugee Studies Centre, and the International Migration Institute
- University of the Highlands and Islands *
- Yorkshire Forward

Individuals

- Mr Andy Bates, Office for National Statistics *
- Mr Bill Band, Scottish Natural Heritage
- Professor Frans Berkhout, Vrije Universiteit in Amsterdam
- Mr Mark Boyce, Scottish Government
- Mr Michael Bright
- Professor Stephen Castles, University of Oxford *
- Professor Tony Champion, Newcastle University *
- Ms Roma Chappell, Office for National Statistics *
- Professor Brian Clark, University of Aberdeen
- Professor Roland Clift
- Professor Joel E. Cohen, The Rockefeller University
- Professor Mike Coombes, Newcastle University *
- Mr Graham Cooper
- Dr Lynne Corner, Newcastle University *
- Professor James Curran, SEPA *
- Ms Jane Davidson AM, Minister for Environment, Sustainability and Housing in the Welsh Assembly Government *
- Ms Angela Davies-Jones, Aberystwyth University *
- Professor Susan Deacon, Queen Margaret University, Edinburgh *
- Professor Danny Dorling, University of Sheffield *
- Professor Tim Dyson
- Professor Paul Ekins, University College London
- Professor Allan Findlay, University of Dundee *
- Dr Derek Flynn, Foresight, Government Office for Science / Department for Business, Innovation and Skills *
- Professor Steve Fothergill, Sheffield Hallam University *

- Mr Robert Gillespie
- Professor John Goddard, Newcastle University
- Mr Dave Gorman, SEPA *
- Mr Richard Grant
- Mr Tony Grayling, Environment Agency
- Professor Phil Hanlon, University of Glasgow *
- Mr Tim Harlow
- Professor Sarah Harper, University of Oxford *
- Mr Steve Hawkins
- Dr Peter Howsam
- Dr Jos Ijpelaar, Department of Finance and Personnel Northern Ireland
- Ms Gunvor Jónsson, University of Oxford *
- Professor Michael Keith, University of Oxford *
- Professor Kay-Tee Khaw, University of Cambridge *
- Dr Paul Leinster, Environment Agency *
- Ms Cecilia Macintyre, General Register Office for Scotland (GROS) *
- Mr Roger Martin, Optimum Population Trust *
- Mr John Mason, Scottish Government *
- Mr Gene R. Masters
- Mr Chris Maxwell, One North East
- Dr David Metz, University College London
- Dr John Moor
- Ms Ilga Nielsen
- Ms Nicola O'Connor, Foresight, Government Office for Science / Department for Business, Innovation and Skills *
- Mr Christopher Padley
- Mr David Payne, former South East England Partnership Board *
- Professor Nick Pidgeon, Cardiff University *
- Professor Jane Plant
- Ms Rosemary Poole
- Mr Steve Quartermain, Department for Communities and Local Government *
- Matthew Quinn, Welsh Assembly Government *
- Professor Philip Rees, University of Leeds
- Ms Esther Roughsedge, General Register Office for Scotland (GROS) *
- Professor Elizabeth Shove, Lancaster University
- Mr Peter Singleton, SEPA *

- Professor Bill Slee, Macaulay Land Use Research Institute *
- Dr William Stanton MBE
- Dr Richard Swann
- Dr Riki Therivel, Levett-Therivel
- Professor Roger Zetter, University of Oxford *

Appendix B

Members of the Royal Commission on Environmental Pollution

Chairman

Professor Sir John Lawton CBE FRS

- President, Council of the British Ecological Society, 2005-2007
- Chief Executive, Natural Environment Research Council, 1999-2005
- Director (and founder), Natural Environment Research Council Centre for Population Biology at Imperial College, Silwood Park, 1989-1999
- Member, Royal Commission on Environmental Pollution, 1996-1999
- Lecturer, Senior Lecturer, Reader, Professor of Biology, University of York, 1972-1989
- Demonstrator in Animal Ecology, Department of Zoology, University of Oxford, 1968-1971
- Chairman, Royal Society for the Protection of Birds, 1993-1998
- Vice-President, Royal Society for the Protection of Birds, 1999-
- Past Vice-President, British Trust for Ornithology, 1999-2007
- Trustee, WWF-UK, 2002-2008; Fellow of WWF-UK, 2008-
- Chairman, Yorkshire Wildlife Trust, 2009-
- Foreign Associate, US National Academy of Sciences, 2008-
- Foreign Honorary Member, American Academy of Arts and Sciences, 2008-

Members

Professor Jon Ayres

- Professor of Environmental and Respiratory Medicine, University of Birmingham, 2008-
- Honorary Professor of Environmental Medicine, University of Warwick, 2004-
- Honorary Professor of Environmental Medicine, University of Aberdeen, 2008-
- Honorary Consultant Physician, UHB NHS Trust, 2008-
- Chair, Department of Health's Committee on Medical Effects of Air Pollutants (COMEAP), 2001- (member since 1992)
- Chair, Defra's Advisory Committee on Pesticides, 2006-
- Past member, Defra's Expert Panel on Air Quality Standards (EPAQS), 1996-2009
- Chair, European Respiratory Society's Environment and Health Committee, 2010- (member 2006-2010)
- Chair, UK Indoor Environments Group (UKIEG), 2008-

- Member, UK Asthma Task Force, 1991-2002
- Member, UK Respiratory Research Collaborative, 2006-

Professor Michael H. Depledge

- Chair of Environment and Human Health, Peninsula Medical School, Universities of Exeter and Plymouth, 2006-
- Former Keeley Visiting Fellow, Wadham College, University of Oxford, 2006-2007
- Honorary Visiting Professor, Department of Zoology, University of Oxford, 2006-
- Senior Science Adviser, Plymouth Marine Laboratory, 2005-2007
- Chief Scientific Adviser, Environment Agency of England and Wales, 2002-2006
- Vice-Chairman, Science Advisory Committee, European Commission, DG-Research, 2006-
- Founding Board Member, Natural England, 2006-2009
- Council Member, Natural Environment Research Council, 2003-2006
- Honorary Professor, School of Earth Sciences and Engineering, Imperial College, 2002-2008
- Honorary Visiting Scientist, School of Public Health, Harvard University, USA, 2000-2003

Professor Maria Lee

- Professor of Law at University College London, 2007-
- Former member of the London Sustainable Development Commission, 2007-2010
- Member of the academic panel of the barristers' chambers Francis Taylor Buildings, 2005-

Professor Peter Liss CBE FRS

- Professor of Environmental Sciences, University of East Anglia, 1985-
- Chair, Scientific Committee of the International Geosphere – Biosphere Programme (IGBP), 1993-1997
- Chair, International Scientific Steering Committee for Surface Ocean – Lower Atmosphere Study (SOLAS), 2002-2007
- Council Member, Natural Environment Research Council, 1990-1995
- Independent Member, Inter-Agency Committee on Marine Science and Technology, 2000-2008
- Chair, Royal Society Global Environmental Research Committee, 2007-
- Council Member, Marine Biological Association of the UK
- Chair, Higher Education Funding Council's Research Assessment Exercise Panel in Earth and Environmental Sciences, 2001
- Guest Professor, Ocean University of Qingdao, China
- President, Challenger Society for Marine Science, 2006-2008
- Chair, European Research Council Advanced Grants Panel in Earth System Science, 2008-

Professor Gordon MacKerron

- Director, SPRU (Science and Technology Policy Research), University of Sussex, 2008-
- Director, Sussex Energy Group, SPRU, University of Sussex, 2005-2008
- Chair of the Committee on Radioactive Waste Management, 2003-2007
- Deputy leader of the UK Government's Energy Review team, PIU, Cabinet Office, June to December 2001
- Chair, The Energy Panel, DTI/OST Technology Foresight Programme, 1995-1998
- Visiting Professor, Imperial College of Science, Technology and Medicine

Professor Peter Matthews OBE

- Board Member, Port of London Authority, 2006-
- Chair, Northern Ireland Authority for Utility Regulation, 2007-
- Chair, Northern Ireland Authority for Energy Regulation, 2006-2007
- Board Member of the Environment Agency and Chair of its Audit Committee, 2000-2006
- Deputy Managing Director, Anglian Water International, 1997-1998
- President of the European Water Association, 1997-1998
- President of Chartered Institution of Water and Environmental Management, 1998-1999
- Chair, Society for the Environment, 2005
- Governor and Chair of its Audit Committee, Anglia Ruskin University, 1998–2007, and Visiting Professor 2007-
- Visiting Professor, Imperial College of Science and Technology, 1991–2004
- Fleet Warden, Worshipful Company of Water Conservators

Professor Judith Petts

- Dean, Social and Human Sciences, University of Southampton, 2010-
- Chair, Environmental Risk Management, University of Southampton, 2010-
- Pro-Vice-Chancellor (Research and Knowledge Transfer), University of Birmingham, 2008-10
- Head, School of Geography, Earth and Environmental Sciences, University of Birmingham, 2002-2007
- Chair, Environmental Risk Management, University of Birmingham, 1999-2010
- Member, Engineering and Physical Sciences Research Council Societal Issues Panel, 2007-
- Council Member, Natural Environment Research Council, 2000-2006
- Member, Environmental Advisory Board, Veolia Environmental, 1999-
- Member, Royal Society Science in Society Group, 2005-2008
- Member, Higher Education Funding Council's Research Assessment Exercise Panel in Geography and Environmental Studies, 2005-2008
- Member, Office of Science and Innovation Sciencewise Strategy Group, 2004-2008
- Member, Environmental Advisory Group, Onyx Environmental Plc, 1999-

- Former Specialist Adviser House of Commons Environment, Transport and Regional Affairs Committee and House of Lords Sub-Committee
- Member, Council of the Institute of Environmental Assessment, 1990-2000

Dr Michael Roberts CBE

- Ministerial appointee to the Veterinary Residues Committee, 2008-
- Non-Executive Director, National Non-Food Crops Centre (NNFCC), 2008-
- Chairman, Partnership Executive Committee, Scottish Government Rural and Environment Research and Analysis Directorate, 2008-
- Chief Executive of the Department for Environment, Food and Rural Affairs (Defra) Central Science Laboratory, 2001-2008
- Director, Centre for Ecology and Hydrology, 1999-2001
- Director, Natural Environment Research Council's (NERC) Institute of Terrestrial Ecology, 1989-1999
- Member, Yorkshire and Humber Science and Innovation Council, 2005-2008

Professor Joanne Scott

- Professor of European Law, and Vice-Dean for International Links, at the Faculty of Laws, University College London
- Member, UCL/Lancet Commission on Managing the Health Effects of Climate Change, 2008-2009
- Member of the editorial boards of the Journal of Environmental Law and the Journal of International Economic Law
- Visiting Professor, Columbia Law School, 2002-2003; spring 2004, 2005, 2007
- Visiting Professor, Harvard Law School, 2005-2006

Professor Marian Scott OBE FRSE

- Professor of Environmental Statistics, University of Glasgow
- Past Chair, Royal Statistical Society, Environmental Statistics Section 2005-2007
- Member, Natural Environment Statistics Advisory Committee, SG, 2007-
- European chair, International Environmetrics Society, 2009-
- Member, Scottish Science Advisory Council, 2010-
- Member, Particles Retrievals Advisory Group (Dounreay), 2009-

Professor Lynda Warren

- Emeritus Professor of Environmental Law, Aberystwyth University
- Deputy Chair, Joint Nature Conservation Committee
- Chair, Wildlife Trust of South and West Wales
- Chair, Wales Coastal and Maritime Partnership
- Member, Committee on Radioactive Waste Management
- Board Member, British Geological Survey

- Board Member, Environment Agency, 2000-2006
- Chair, Salmon and Freshwater Fisheries Review, 1998-2000
- Member, Radioactive Waste Management Advisory Committee, 1994-2003
- Member, Countryside Council for Wales, 1991-2003
- Trustee, Field Studies Council 2006-2009
- Trustee, WWF-UK, 2002-2005
- Visiting Professor, Birmingham Central University

Members who retired from the Commission before the report was published:

- Professor Nicholas Cumpsty
- Dr Ian Graham-Bryce, CBE
- Professor Jeffrey Jowell, QC
- Professor Steve Rayner

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Abbreviations

AQMAs	Air Quality Management Areas
AQS	Air Quality Strategy
CLG	Department for Communities and Local Government
CO_2	carbon dioxide
COMEAP	Committee on the Medical Effects of Air Pollution
CPRE	Campaign to Protect Rural England
Defra	Department for Environment, Food and Rural Affairs
DECC	Department of Energy and Climate Change
DfT	Department for Transport
EIA	Environmental Impact Assessment
EiP	Examination in Public
EST	Energy Saving Trust
EU	European Union
GB	Great Britain
GHG	greenhouse gas
GLA	Greater London Authority
GOSE	Government Office for the South East
GP	General Practitioner
GQA	General Quality Assessment
GROS	General Register Office for Scotland
HOPS	Household Projections System
HRA	Habitats Regulations Appropriate Assessment
HRRs	household representative rates
JNCC	Joint Nature Conservation Committee
LDPs	Local Development Plans
LRO	Lincolnshire Research Observatory
NO_2	nitrogen dioxide
NPF	National Planning Framework
NPF2	Second National Planning Framework (Scotland)
Ofwat	Office of Water Supplies, the Water Services Regulation Authority
ONS	Office for National Statistics

PM_{10}	particles of less than ten microns in aerodynamic diameter
PCBs	polychlorinated biphenyls
PPG	Planning Policy Guidance
PPS	Planning Policy Statement
RCEP	Royal Commission on Environmental Pollution
RDS	Regional Development Strategy
RES	Regional Economic Strategy
RRA	Responsible Regional Authority
RS	Regional Strategy
RSPB	Royal Society for the Protection of Birds
RSS	Regional Spatial Strategy
SA	Sustainability Appraisal
SDPs	Strategic Development Plans
SEA	Strategic Environmental Assessment
SoS	Secretary of State
TANs	Technical Advice Notes (Wales)
TFR	total fertility rate
UK	United Kingdom
VOCs	volatile organic compounds
WFD	Water Framework Directive

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