Environment

Chapter 11

- Emissions of greenhouse gases in the United Kingdom fell by 12.5 per cent between 1990 and 2004, although they rose between 2002 and 2004. (Figure 11.2)

- Around 4 per cent of electricity produced in the United Kingdom in 2003 came from renewable sources, compared with an EU-15 average of 15 per cent. (Table 11.5)

- Sulphur dioxide emissions in the United Kingdom fell by 43 per cent between 1970 and 1990, and then by a further 74 per cent between 1990 and 2003. (Figure 11.12)

- The United Kingdom disposed of 74 per cent of its municipal waste by landfill in 2003, a higher proportion than in most other EU-15 countries, with the exception of Greece and Portugal. (Table 11.15)

- The area of new land planted each year with conifers in Great Britain fell by 83 per cent between 1990/91 and 2004/05, while the planting of broadleaved trees rose by 36 per cent in the same period. (Figure 11.21)

- In 2004 North Sea cod stocks were 73 per cent lower than in 1980, but there was a small increase between 2001 and 2004. (Figure 11.23)

Human activities affect the physical environment and natural resources at both the local and global level. Industrialisation has led to huge pressures on the land, wildlife, atmosphere and waters. Increasingly governments are developing policies and regulations to reduce the adverse effects modern lifestyles have on the environment.

Global warming and climate change

The temperature of the earth is determined by a balance between energy from the sun and radiation from the surface of the earth to space. Some of this outgoing radiation is absorbed by naturally occurring gases such as water vapour and carbon dioxide. This creates a greenhouse effect that keeps the surface of the earth around 33 degrees Celsius (°C) warmer than it would otherwise be and helps to sustain life.

Both global and local (as measured in central England) average temperatures have risen over the long term since the late 19th century, though there have been fluctuations around this trend (Figure 11.1). Average global surface temperatures have increased by around 0.6°C over this period. All ten of the hottest years since global records began in 1861 have been during the period 1990–2004, with 1998 the warmest year and 2004 coming fourth. Current climate models predict that global temperatures will rise by between 1.4 and 5.8°C by the end of the 21st century.

During the 20th century, the annual mean temperature for central England warmed by about 1°C. The 1990s were exceptionally warm in central England by historical standards, and about 0.6°C warmer than the 1961–90 average. Four of the five warmest years since national records began in 1772 have occurred since 1990, and 2004 was the ninth. The highest temperature ever recorded in the United Kingdom was in August 2003, when temperatures peaked at 38.5°C at the observing station at Brodgate in Kent. Climate change models suggest that the average temperature across the United Kingdom could increase by between 2.0 and 3.5°C by the 2080s, with the level of warming dependent on future global greenhouse gas emissions.

The Intergovernmental Panel on Climate Change reported in 2001 that there is new and stronger evidence that most of the warming over the last 50 years is attributable to human activities. The predominant factor among these activities is the emission of 'greenhouse gases', such as carbon dioxide, methane and nitrous oxide.

Under the Kyoto Protocol, the United Kingdom has a legally binding target to reduce its emissions of a 'basket' of six greenhouse gases by 12.5 per cent over the period 2008–12. This reduction is against emission levels in 1990 for carbon dioxide, methane and nitrous oxide, and 1995 for hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride – see Appendix, Part 11: Global warming and climate change. Additionally, the Government intends to move beyond that target towards a goal of reducing carbon dioxide emissions to 20 per cent below 1990 levels by 2010. It is estimated that in 2004, emissions of the basket of six greenhouse gases, weighted by global warming potential, were about 12.5 per cent below the base year level (Figure 11.2). However, emissions have risen by about 2 per cent since 2002, mainly because of increased carbon dioxide emissions from industry and transport.

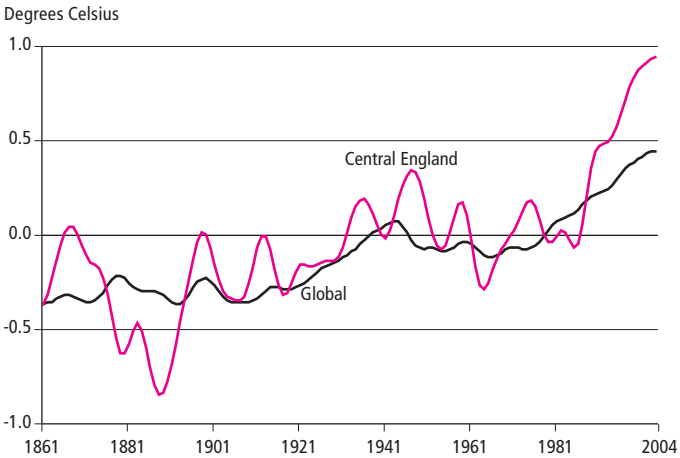
Similarly, the European Union (EU) is committed to reducing emissions of these six greenhouse gases to 8 per cent below the 1990 level over the 'commitment period' of 2008–12. This target only applies to the 15 Member States (EU-15) that formed the EU when the Protocol was ratified in May 2002. However the ten accession countries that joined the EU in May 2004 have all since ratified the Protocol, and have their own Kyoto targets of between 6 and 8 per cent.

Total EU-15 emissions fell by 1.4 per cent between 1990 and 2003, despite emissions increasing in ten Member States between these years. The overall fall was largely due to reductions in emissions of over 18 per cent in Germany and 13 per cent in the United Kingdom. However about half of these reductions can be attributed to one-off factors: economic restructuring following reunification in Germany, and increased

Figure 11.1

Difference in average surface temperature: deviation from 1961–90 average[1]

Global and central England

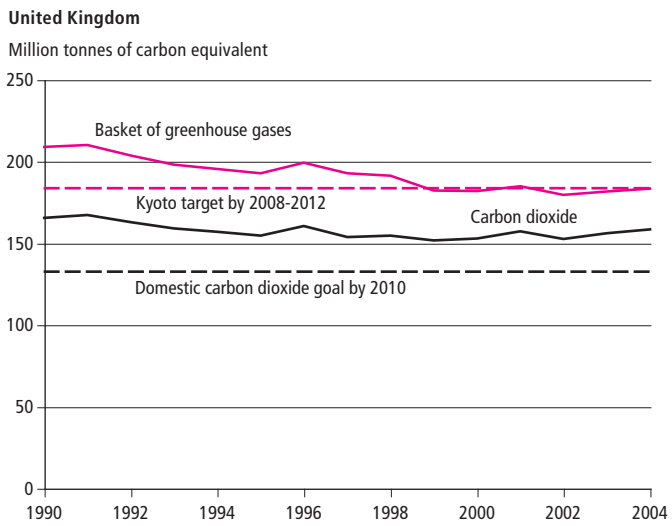


1 Data are smoothed to remove short term variation from a time series to get a clearer view of the underlying changes.

Source: Hadley Centre for Climate Prediction and Research

Figure 11.2

Emissions of greenhouse gases[1]

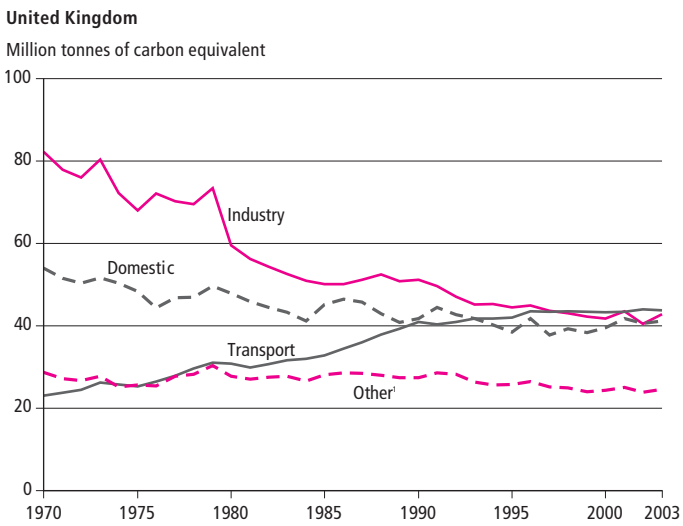


1 See Appendix, Part 11: Global warming and climate change.

Source: Department for Environment, Food and Rural Affairs; National Environmental Technology Centre

Figure 11.3

Carbon dioxide emissions: by end user



1 Includes commercial and public sector, agriculture, and military ships and aircraft.

Source: National Environmental Technology Centre

use of gas for electricity generation following changes in energy regulation in the United Kingdom. In 2003 these two countries continued to generate more emissions than any other country in the EU-15, with Germany generating almost a quarter, and the United Kingdom a sixth, of the EU-15 total.

Carbon dioxide (CO_2) is the most important greenhouse gas, accounting for around 86 per cent of greenhouse gas emissions within the United Kingdom in 2003. The industry and the transport sectors each accounted for just over 28 per cent of emissions, and domestic users accounted for a further 27 per cent (Figure 11.3). For these data, emissions from power stations that generate electricity are allocated to those sectors using that electricity.

Between 1970 and 2003, total carbon dioxide emissions fell by 19 per cent. Much of this decline has come from a reduction in emissions attributable to industry, which fell steeply in the late 1970s and early 1980s, declined more steadily from that point, and then levelled off from 1997. The overall result has been a 48 per cent reduction between 1970 and 2003. Emissions by domestic users have declined by 24 per cent since 1970, but those attributable to transport have increased by 89 per cent. Furthermore, these data do not include figures for international aviation and shipping. Greenhouse gas emissions from these sources in the United Kingdom can be estimated from refuelling from bunkers at UK airports and ports by both UK and non-UK operators.

Reflecting the growth in air travel (see Figure 12.1), carbon dioxide emissions from aviation fuel use increased by almost 90 per cent between 1990 and 2003. Additionally, because emissions at high altitude interact directly with the upper atmosphere, aviation has a greenhouse effect that is greater than emissions at ground level. Emissions attributed to fuel stored in UK shipping bunkers fell by about a fifth, but UK shipping operators purchase most of their bunker fuel outside the United Kingdom.

Use of resources

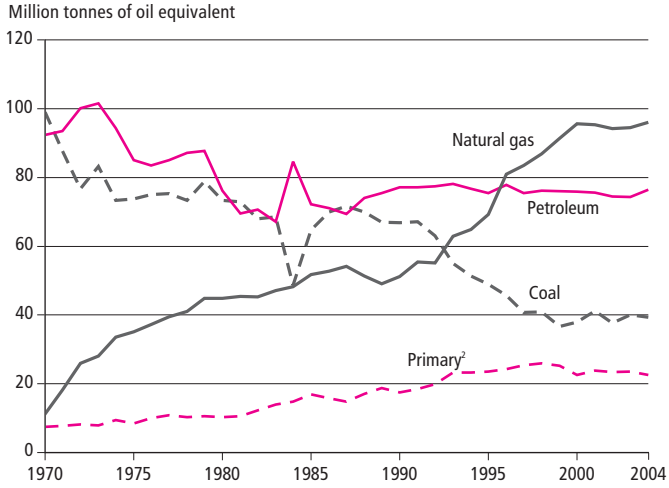
Greenhouse gas-producing fossil fuels accounted for 90 per cent of fuels used in the production of energy in the United Kingdom in 2004. The use of coal and petroleum for the production of energy fell between 1970 and 2004, by 60 per cent and 17 per cent respectively (Figure 11.4 overleaf). Following fluctuations in consumption that can be attributed to various conflicts in the petroleum-producing countries of the Middle East, consumption of petroleum has remained relatively stable since 1990. Consumption of coal has declined over the long term, along with coal production, although consumption has stabilised somewhat since the late 1990s following an increase in demand by power stations.

Despite this, total consumption of fuels for energy use has increased steadily. Natural gas and to a lesser extent primary electricity, which comes from sources such as nuclear, hydroelectric and renewables, have become increasingly important. Natural gas from the North Sea started to be produced in substantial quantities from the early 1970s. Consumption exceeded that of petroleum for the first time in 1996, and by 2004 was nearly nine times what it was in 1970.

Figure 11.4

Consumption of fuels[1] for energy use

United Kingdom



1 See Appendix, Part 11: Fuels for energy use.
2 Includes nuclear, hydroelectric and renewable energy.

Source: Department of Trade and Industry

Consumption of primary sources of electricity in 2004 was two and half times the level it was in 1970. Since a peak in 1998, overall consumption from primary sources has been declining, but within this, consumption of primary electricity from renewable sources continued to increase throughout the period. The development of these primary sources of electricity will play an important part in reducing future UK carbon dioxide emissions.

The United Kingdom was the first country to use nuclear power on an industrial and commercial scale when the Calder Hall power station was commissioned by the United Kingdom Atomic Energy Authority in 1956. The consumption of nuclear energy in the United Kingdom has fallen since the late 1990s. Nearly a quarter of the electricity produced in the United Kingdom in 2003 was generated by nuclear power stations, a similar proportion to Germany, Spain and Finland (Table 11.5). France produces over three quarters of its electricity from nuclear power, but nearly half the countries in the EU-25 have no developed nuclear production capacity.

Renewable electricity can be generated from wind (both offshore and onshore), water (hydro, wave and tidal power), sunlight (the direct conversion of solar radiation into electricity, called photovoltaics or PV), biomass (energy from forestry, crops or biodegradable waste) and from the earth's heat (geothermal energy). None of these forms of generation, except biomass, involves the production of carbon dioxide, and biomass generation produces only the carbon that the material has absorbed from the atmosphere while growing.

Table 11.5

Electricity generation: by fuel used, EU comparison, 2003

Percentages

	Coal and lignite	Petroleum products	Natural and derived gases	Nuclear	Renewable sources	All fuels (=100%) (thousand GWh)
Germany	51	1	11	28	9	599.5
France	5	2	4	78	12	566.9
United Kingdom	35	2	38	22	4	398.6
Italy	13	26	42	-	19	293.9
Spain	28	9	15	24	23	262.9
Poland	93	2	3	0	3	151.6
Sweden	2	3	1	50	44	135.6
Netherlands	25	3	62	4	5	96.8
Belgium	11	1	28	56	3	84.6
Finland	31	1	17	27	23	84.2
Czech Republic	61	-	4	31	3	83.2
Austria	13	3	19	0	64	63.2
Greece	60	15	14	0	11	58.5
Portugal	31	13	17	0	39	46.9
Denmark	55	5	21	0	19	46.2
Hungary	27	5	35	32	1	34.1
Slovakia	19	2	9	57	12	31.2
Ireland	33	10	52	0	6	25.2
Lithuania	-	2	13	79	5	19.5
Slovenia	36	-	3	37	23	14.0
Estonia	92	-	7	0	-	10.2
Cyprus	0	100	0	0	0	4.0
Latvia	1	2	39	0	59	4.0
Luxembourg	0	-	72	0	28	3.6
Malta	0	100	0	0	0	2.2
EU-15 total	27	5	20	32	15	2,766.4
EU-25 total	31	5	19	31	14	3,120.5

Source: Eurostat

Around 4 per cent of electricity produced in the United Kingdom in 2003 came from renewable sources, among the lowest proportions in the EU-15 where the average is 15 per cent. In the EU-25 Austria, Latvia and Sweden produce the greatest proportions. The UK figure reflects its historical use of coal and gas resources and the absence of both high mountains, which facilitate large scale hydro generation, and extensive forests that enable biomass generation. There is, however, scope to develop extensive wind and wave power. Under its Renewables Obligation, introduced to provide market incentives for renewable energy, the UK Government is committed to increase the contribution of electricity from renewable sources

Table 11.6

Electricity generated from renewable resources

United Kingdom Gigawatt hours

	1990	1995	2000	2003	2004
Hydro	5,207	4,838	5,085	3,228	4,930
Landfill gas	139	562	2,188	3,276	4,004
Wind and wave	9	392	946	1,286	1,935
Co-firing with fossil fuels	-	-	-	602	1,022
Municipal solid waste combustion[1]	141	471	840	965	971
Other biofuels[2]	-	199	487	937	927
Sewage sludge digestion	316	410	367	343	379
Solar photovoltaics	-	-	1	3	4
Total	5,812	6,871	9,914	10,638	14,171

1 Biodegradable part only.
2 Includes electricity from farm waste digestion, poultry litter combustion, meat and bone combustion, straw and short rotation coppice.

Source: Department of Trade and Industry

in the United Kingdom so that by 2010, 10 per cent of licensed electricity sales should be from eligible renewable sources. The EU-wide target is that 22 per cent of electricity should be generated from renewable sources by 2010.

The amount of electricity generated from renewable sources in the United Kingdom more than doubled between 1990 and 2004 (Table 11.6). The biggest increases in production, among those renewable resources used widely in both 1990 and 2004, came from exploiting landfill gas, and wind and wave power. Hydro sources have traditionally accounted for the bulk of electricity generated from renewable resources, although in 2003 dry weather led to a substantial fall in output of 38 per cent. Very little energy was generated from wind and wave power in 1990, but it accounted for 14 per cent of the electricity generated from renewable resources in 2004. This increase was driven in part by the Renewables Obligation targets, which wind farms are best placed to meet.

By June 2005 the UK energy industry had installed over 1,000 megawatts (MW) of wind generating capacity, making it one of only eight countries in the world to have this level of wind power. Germany had the greatest installed capacity, with over 16 times that of the United Kingdom, while Spain had over 8 times.

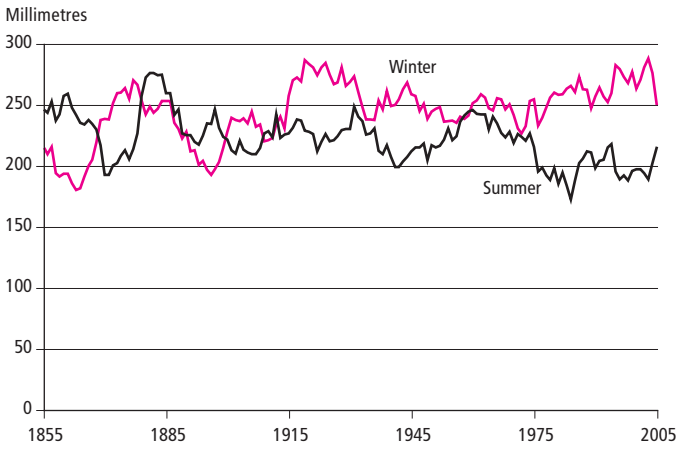
Although the United Kingdom overall does not suffer from a lack of rain, water is a resource that needs to be managed carefully. Rainfall across the United Kingdom is usually well distributed through the year, but since the 1960s there has been a tendency towards wetter winters and drier summers in England and Wales (Figure 11.7). Over the last ten years winter rainfall has, on average, exceeded summer rainfall by almost 100 millimetres, the greatest margin in records stretching back to 1766. In contrast, summer rainfall was greater than winter rainfall for extended periods during the 19th century.

Climate change predictions suggest that winters in the United Kingdom may become wetter and summers drier, as demonstrated by the recent trend for England and Wales. In south east England these changes could amount to as much as a 50 per cent reduction in summer precipitation from the

Figure 11.7

Winter and summer rainfall[1,2]

England & Wales



1 Figures are ten-year rolling averages ending in year shown.
2 Winter is December to February, summer is June to August.

Source: Climate Research Unit, University of East Anglia; Hadley Centre for Climate Prediction and Research; Centre for Ecology & Hydrology (CEH-Wallingford)

1961–90 average by the 2080s. However there is considerable uncertainty about future rainfall patterns and given the natural variability of the UK climate any short-term trends should be treated with caution. For example, in 2004 the United Kingdom experienced its wettest August since 1956.

Changes in seasonal patterns of rainfall and temperature have important implications for water resources and flood risk. An increase in rainfall over the winter – when evaporation losses are lowest – could increase flood frequency but would generally be beneficial for water resources. On the other hand lower summer rainfall can, as in 1995 and 2003, lead to pressure on water resources (for example, increased demands for irrigation and garden watering) particularly during hot summers. Hot, dry summers also result in exceptionally dry soils. Autumn and winter rainfall must then restore soil moisture before water becomes available for the recovery of river flows and the replenishment of reservoirs and aquifers (underground sources of water).

Following widespread drought conditions in 1995 and 1996, overall reservoir stocks recovered in 1997 and remained stable throughout most of the 1998–2002 period. Most reservoirs were close to capacity in January 2003 but stocks declined steeply from May and fell marginally below previous seasonal lows in a few, mostly southern, reservoirs in the autumn – triggering calls to moderate water usage. High rainfall over the final weeks of 2003 helped restore overall stocks almost back to the normal winter levels. The mild, dry winter of 2004/05 resulted in relatively low reservoir inflows. Stocks, in southern England particularly, were depleted by the late summer of 2005 when hosepipe bans were in operation in parts of the south-east.

In 2003, 37,400 megalitres of water were abstracted from non-tidal surface water and groundwater every day in England and Wales. Of this, two fifths was for the public water supply, and about the same for the electricity supply industry (Figure 11.8). The amount of water abstracted has generally risen since the mid-1990s, although most of this rise was because the electricity supply industry's demand for water nearly doubled between 1995 and 2003.

In 2004/05, 3,608 megalitres of water were lost through leakage from the public supply every day in England and Wales, equivalent to 23 per cent of the total distribution input. This was 29 per cent lower than in the peak year of 1994/95 and slightly lower than in 2003/04.

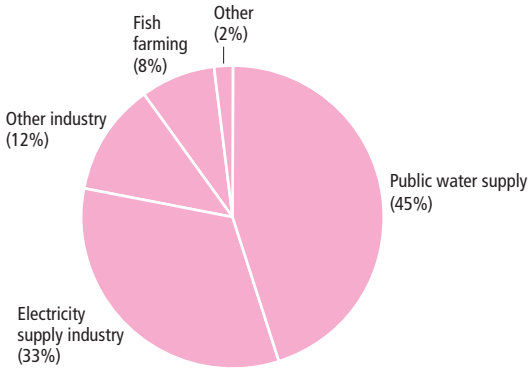
Water suppliers in the United Kingdom are required to supply wholesome water and are responsible for assessing the quality of the water they supply. In 2003, 99.8 per cent of assessments complied with the relevant standards.

Figure 11.8

Water abstractions:[1] by use, 2003

United Kingdom

Percentages



Total water abstractions: 37,400 megalitres per day

1 From non-tidal surface water and groundwater.

Source: Department for Environment, Food and Rural Affairs

Pollution

Pollution affects land, the atmosphere and both the sea and inland waters. Rivers and canals in the United Kingdom are generally in a favourable condition, and both chemical and biological quality have improved in recent years. In particular, the chemical quality of rivers in England improved since 1990, so that 93 per cent of river length was classified as being in good or fair condition in 2004 (Table 11.9). Wales, Scotland and Northern Ireland had 98, 97 and 93 per cent in good or fair condition, respectively. However different systems of classification have been used in these national surveys so the results are not directly comparable.

Improvements in water quality since 1990 are thought to be largely attributable to the investment programme of the water industry and pollution control measures. However the chemical quality of rivers and canals is not only affected by direct human activity. Lower than average rainfall can result in low river flows, and can also have an adverse effect on river water quality by reducing the dilution of pollutants.

Biological water quality tests are also carried out across the United Kingdom, by monitoring tiny animals (macro-invertebrates) that live in or on the bed of rivers. The number and diversity of freshwater species found in samples can be used to make inferences about water quality, since research has shown that there is a relationship between species composition and water quality. In 2004 the percentage of river length in

Table 11.9

Chemical quality[1] of rivers and canals: by country

United Kingdom — Percentage of total river length

	England	Wales	Scotland[2]	Northern Ireland
1990[3]				
Good	43	86	..	44
Fair	40	11	..	51
Poor	14	2	..	4
Bad	3	1	..	1
2000				
Good	64	93	87	58
Fair	29	5	10	37
Poor	6	1	3	4
Bad	-	-	-	0
2004				
Good	62	94	87	58
Fair	31	4	10	35
Poor	7	2	3	7
Bad	1	-	-	-

1 See Appendix, Part 11: Rivers and canals.
2 Data for Scotland are collected on a different basis to the rest of the United Kingdom.
3 Northern Ireland figures are for 1991.

Source: Environment Agency; Scottish Environment Protection Agency; Environment and Heritage Service, Northern Ireland

Table 11.10

Bathing water – compliance with EC bathing water directive coliform standards:[1] by Environment Agency region[2]

United Kingdom — Percentages

	1993	1997	2001	2005
United Kingdom	80	88	95	98
England	79	88	98	99
North East	82	91	100	96
North West	38	50	88	94
Midlands	.	.	.	.
Anglian	85	97	97	100
Thames	100	100	100	100
Southern	87	89	99	100
South West	81	91	98	99
Wales	84	92	93	100
Scotland	78	74	84	95
Northern Ireland	94	88	81	94

1 During the bathing season. See Appendix, Part 11: Bathing waters.
2 England and Wales only.

Source: Environment Agency; Scottish Environment Protection Agency; Environment and Heritage Service, Northern Ireland

good or fair condition as measured by this criterion in England, Wales and Northern Ireland was 95 per cent, 99 per cent and 98 per cent, respectively.

Pollution from the land and rivers can also affect the seas around the United Kingdom. The microbiological quality of bathing waters can be polluted by sewage effluent, storm water overflows and river-borne pollutants that could affect human health, as well as pollutants from shipping and other sea-borne activities. The European Commission (EC) bathing water directive sets compulsory limits on acceptable levels for a number of physical, chemical and microbiological pollutants in bathing waters, with total and faecal coliforms considered to be the most important. Coliforms are bacteria that inhabit the intestines of humans and other vertebrates.

There has been an increase in the number of UK bathing waters complying with the EC bathing water directive coliform standards during the bathing season (Table 11.10). In England this amounted to an increase of 20 percentage points between 1993 and 2005, to 99 per cent compliance. Wales achieved 100 per cent compliance in 2005, Scotland 95 per cent and Northern Ireland, 94 per cent.

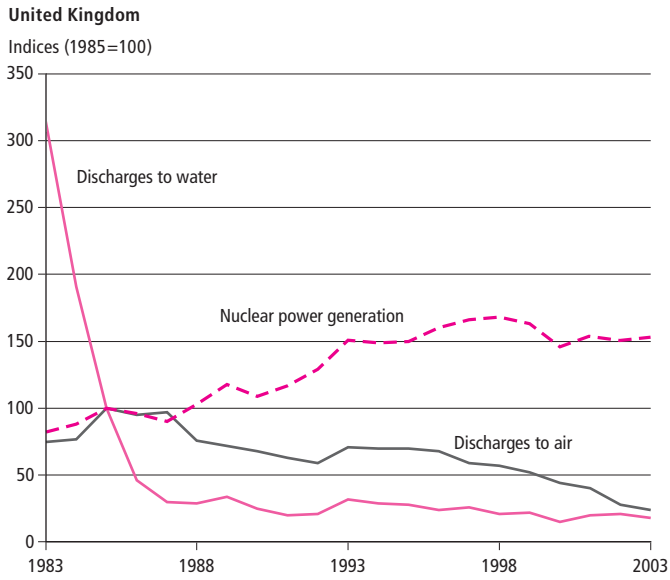
Compliance with more stringent guideline standards (which is one of the requirements for Blue Flag beach status awarded by the Foundation for Environmental Education) was 74 per cent for the United Kingdom in 2005. In Wales 91 per cent of coastal bathing waters met this guideline standard compared with 74 per cent in England, 69 per cent in Northern Ireland and 55 per cent in Scotland. The trend towards improved bathing water quality is expected to continue as further improvements are made to sewerage infrastructure affecting coastal waters, and through tackling diffuse pollution.

Between 1985 and 2003 radioactive emissions to water in the United Kingdom fell by 82 per cent, and emissions to air fell by around 76 per cent (Figure 11.11 overleaf). During the same period electricity production from nuclear sources increased by around 50 per cent. Radioactive discharges are the less toxic waste products from electricity generation, as well as from the medical and scientific industries, which are emitted under regulation to air and water.

However, radiation from these artificial sources is estimated to account for less than 15 per cent of the total annual average exposure to the UK population. Most of this exposure from artificial sources comes from medical sources. Less than 1 per cent of the total exposure comes from occupational sources, fallout, discharges or consumer products such as smoke

Figure 11.11

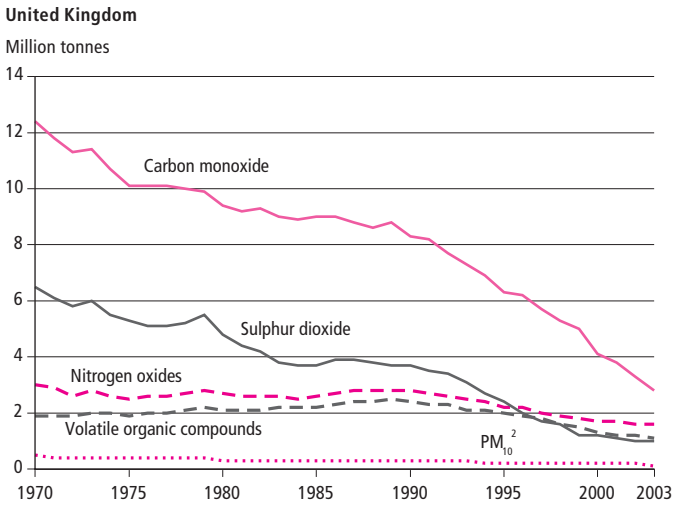
Discharges from the nuclear industry



Source: Department for Environment, Food and Rural Affairs

Figure 11.12

Emissions of selected air pollutants[1]



1 See Appendix, Part 11: Air pollutants.
2 Particulate matter that is less than 10 microns in diameter.

Source: Department for Environment, Food and Rural Affairs; National Environmental Technology Centre

detectors. The annual average dose is estimated to be around 0.4 millisieverts (mSv). In the United Kingdom, individual doses from artificial sources (excluding medical procedures such as radiography) must be below 1 mSv per year, by law.

Fallout accounts for a very small proportion (0.2 per cent) of total radioactive exposure in the United Kingdom. Before 1985 the main source of exposure to fallout was from nuclear weapons testing that took place between the late 1940s and early 1960s. The average annual dose from this source reached a peak of 0.14 mSv in the early 1960s. Following the implementation of the Partial Nuclear Test Ban Treaty of 1963, average annual dose fell steadily to 0.006 mSv in 1985. The Chernobyl reactor incident in 1986 caused a near fivefold increase in the average annual dose from fallout in that year, but by 1997 this had gone down to pre-Chernobyl levels.

Emissions of the major air pollutants in the United Kingdom have generally been falling since the 1970s, and the rate of decline has accelerated since 1989 (Figure 11.12). Carbon monoxide (CO) reduces the capacity of the blood to carry and deliver oxygen. Emissions of carbon monoxide fell by 33 per cent between 1970 and 1990, followed by a 67 per cent reduction between 1990 and 2003, mainly as a result of the introduction of catalytic converters in petrol-driven cars.

Sulphur dioxide (SO_2) is an acid gas that can affect both human health and vegetation. It affects the lining of the nose, throat and lungs, particularly among those with asthma and chronic lung disease. Sulphur dioxide emissions fell by 43 per cent between 1970 and 1990, and then by 74 per cent between 1990 and 2003, largely as a result of a reduction in coal use by power stations and the introduction of the desulphurisation of flue gas at two power stations. However, the rate of decline slowed after 1999. Nitrogen oxides (NOx) are also acid gases and can have similar effects to sulphur dioxide. Emissions of nitrogen oxide pollutants fell by 44 per cent between 1990 and 2003.

Particulate matter that is less than 10 microns in diameter, known as PM_{10}, is generated primarily by combustion processes, as well as from processes such as stone abrasion during construction, mining and quarrying. Particulate matter can be responsible for causing premature deaths among those with pre-existing heart and lung conditions. Emissions fell by 51 per cent between 1990 and 2003.

Fossil fuel combustion is the main source of air pollution in the United Kingdom, with road transport and power stations the most important contributors. Emissions of other pollutants are more evenly spread among different sources, although road transport and electricity generation are, again, important contributors. In 2003, road transport accounted for 49 per cent of carbon monoxide emissions, and 40 per cent of nitrogen oxide emissions (Table 11.13). Although the level of road traffic has continued to grow over the last decade (see Figure 12.1), changes in vehicle technology have reduced the impact of emissions from this sector. In 1990 road transport accounted for 66 per cent of carbon monoxide emissions and for 47 per cent of nitrogen oxide emissions. Power stations produced 69 per cent of sulphur dioxide and 24 per cent of nitrogen oxide emissions in 2003, compared with 74 per cent and 27 per cent respectively in 1990.

Table 11.13

Air pollutants:[1] by source, 2003

United Kingdom Percentages

	Carbon monoxide	Nitrogen oxides	Volatile organic compounds	Sulphur dioxide	PM_{10}[2]
Road transport	49	40	15	-	27
Power stations	3	24	1	69	7
Manufacturing and industry[3]	28	18	16	16	26
Solvent use	-	-	35	-	4
Domestic	15	7	4	3	14
Extraction and distribution of fossil fuels	1	-	28	1	1
Refineries	-	2	-	7	1
Commercial and institutional	-	2	-	1	1
Other	4	7	2	3	18
All sources (=100%) (million tonnes)	2.8	1.6	1.4	1.0	0.2

1 See Appendix, Part 11: Air pollutants.
2 Particulate matter that is less than 10 microns in diameter.
3 Includes industrial processes and other energy industry.

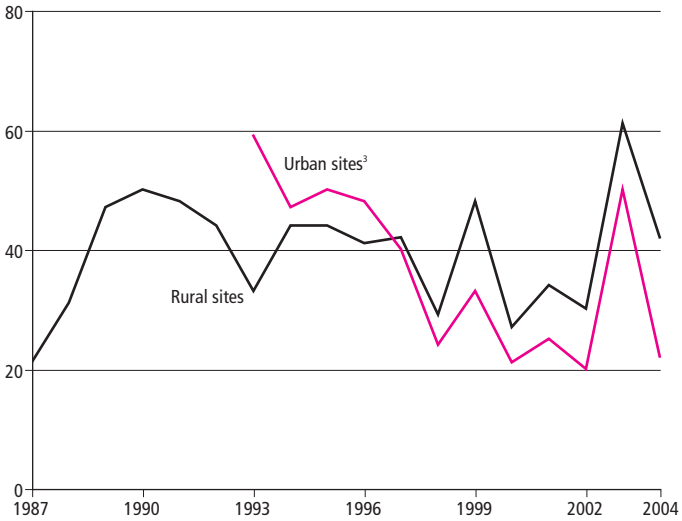
Source: National Environmental Technology Centre

Figure 11.14

Days when air pollution[1] is moderate or higher[2]

United Kingdom

Average number of days per site



1 Any one of five pollutants: carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide and particulate matter less than 10 microns in diameter.
2 Assessed against the Air Pollution Information Service bandings.
3 Data not available before 1993.

Source: Department for Environment, Food and Rural Affairs; National Environmental Technology Centre

Some pollutants, particularly sulphur dioxide, nitrogen oxides and ammonia (NH_3), can cause harm to the environment through acid deposition. This deposition consists of both wet processes (through polluted rainfall – 'acid rain') and dry processes (by removal of gases and particles from the atmosphere at the land surface) and can occur hundreds of kilometres away from the source of emissions. The percentage of areas of sensitive habitats where critical loads (the levels at which significant harm is caused) were exceeded in the United Kingdom fell between 1996 and 2002, from 73 per cent to 55 per cent. The largest reduction, from 68 per cent in 1996 to 43 per cent in 2002, was in Scotland.

One result of the reduction in emissions of air pollutants has been a fall in the average number of days when levels of any one of a basket of five pollutants (carbon monoxide, nitrogen dioxide, ozone, particulate matter and sulphur dioxide) were 'moderate or higher', according to the Air Pollution Information Service bandings (Figure 11.14). These five pollutants are recognised as the most important for causing short term health problems. In 1993 air pollution monitoring sites in urban areas recorded an average of 59 days per site when air pollution was moderate or higher, but by 2004 this figure had fallen to 22 days, largely because of a reduction in particles and sulphur dioxide.

There is no clear trend in pollution at rural sites and it is much more variable, largely due to fluctuations in levels of ozone, the main cause of pollution in such areas. The production of ozone at ground level is strongly influenced by the weather, as it is created on sunny days. This results in days of pollution in rural areas being concentrated in the warmer months, whereas those in urban areas are spread more evenly throughout the year. The impact of warm weather can been seen in Figure 11.14, when the hot summers of 1999 and 2003 resulted in a sharp increase in the numbers of days with average or higher pollution in both rural and urban areas.

Waste management

The United Kingdom disposed of 74 per cent of its municipal waste (mainly household waste) by landfill in 2003. This was among the highest rates of landfill disposal of municipal waste in the EU-15, behind Greece, 92 per cent, and Portugal, 75 per cent (Table 11.15 overleaf). Comparisons between countries need to be treated with some care because of differences in definitions. 'Recycling and other' can be considered to be mainly recycling except in Germany where a large proportion of waste is used in the manufacture of fuel for energy use. The Netherlands, Austria, Germany and Belgium had the highest rates of recycling, while Denmark incinerated most of its municipal waste. However the

Table 11.15

Municipal waste management: EU comparison,[1] 2003

Percentages

	Landfill	Recycled and other	Incineration	Waste generated per head (=100%) (kilograms)
Ireland	*69*	*31*	*0*	732
Denmark	*5*	*41*	*54*	675
Luxembourg	*23*	*36*	*42*	658
Germany	*20*	*57*	*23*	638
Austria	*30*	*59*	*11*	610
Spain	*59*	*34*	*7*	609
Netherlands	*3*	*64*	*33*	599
United Kingdom	*74*	*18*	*8*	592
France	*38*	*28*	*34*	561
Italy	*62*	*29*	*9*	523
Sweden	*14*	*41*	*45*	471
Portugal	*75*	*4*	*22*	452
Finland	*63*	*28*	*9*	450
Belgium	*13*	*52*	*36*	446
Greece	*92*	*8*	*0*	428

1 EU-15 countries.

Source: Department for Environment, Food and Rural Affairs

United Kingdom was ranked in the middle of all EU-15 countries in terms of the amount of waste produced per head. It is estimated that around 577 kilogrammes of municipal waste is produced on average by each person in the EU-15 countries every year.

Eurostat has estimated that a total of around 2 billion tonnes of waste is generated in the EU-15 every year. Almost a third comes from agriculture and forestry and broadly the same amount from construction and demolition. A similar proportion of waste comes from the mining and quarrying and the manufacturing sectors, with municipal waste accounting for only 6 per cent.

According to the Municipal Waste Management Survey, about 29.1 million tonnes of municipal waste were collected in England in 2003/04, a decrease of 1 per cent from the 29.4 million tonnes collected in 2002/03. Household waste accounted for 87 per cent of municipal waste in 2003/04. This represented about 25.4 million tonnes of waste, an average of 23.1 kilograms per household per week. Compared with 2002/03, total household waste decreased by 1.5 per cent.

The amount of household waste collected for recycling in England nearly trebled between 1996/97 and 2003/04 to 4.5 million tonnes (Table 11.16). This represented an average of 4.1 kilograms collected per household per week. It includes materials taken to civic amenity sites and other drop-off points provided by the local authority as well as those collected directly from households.

The Government target is for 25 per cent of household waste to be recycled by 2005/06. In 2003/04, 18 per cent was recycled, exceeding the interim 2003/04 recycling (including composting) target of 17 per cent. Compost, followed by paper and card, make up the largest proportions of recycled material, and accounted for 30 per cent and 28 per cent of recycled materials in 2003/04.

There was wide variation in household recycling rates across England in 2003/04. Each local authority was set individual

Table 11.16

Materials collected from households for recycling[1]

England Thousand tonnes

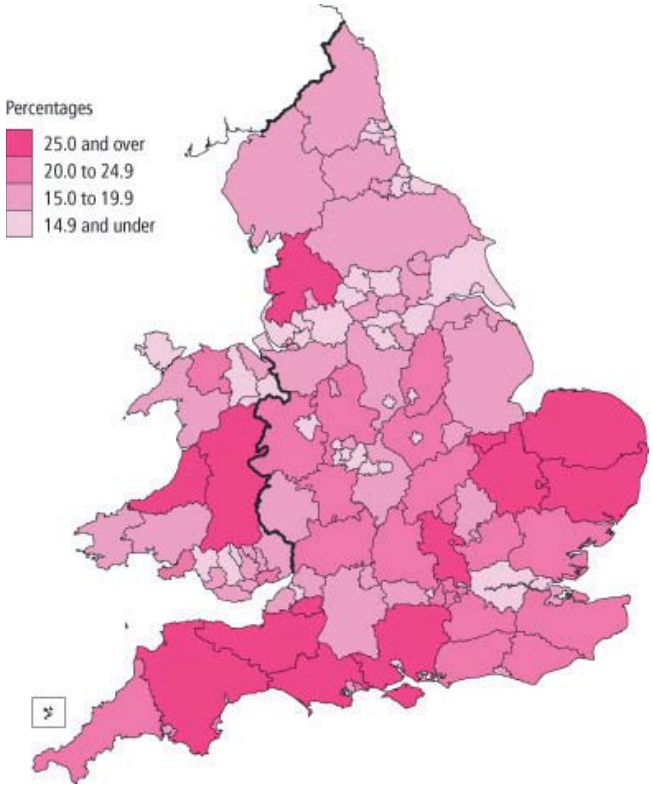
	1996/97	1998/99	2000/01	2002/03	2003/04
Compost[2]	278	454	798	1,189	1,360
Paper and card	554	783	910	1,126	1,271
Glass	308	347	396	470	568
Scrap metal/white goods	198	253	310	419	464
Co-mingled and other materials[3]	281	257	363	536	853
Total	1,619	2,094	2,777	3,740	4,516

1 Includes data from different types of recycling schemes collecting waste from household sources, including private/voluntary schemes such as kerbside and 'bring' systems.
2 Includes organic materials (kitchen and garden waste) collected for centralised composting. Home composting is not included.
3 Co-mingled materials are separated after collection. Other includes textiles, cans, plastics, oils, batteries and shoes.

Source: Department for Environment, Food and Rural Affairs

Map 11.17

Household waste recycling:[1] by waste disposal authority,[2] 2003/04



1 Includes composting.
2 These boundaries generally match county or unitary authority boundaries, except for metropolitan districts in West Yorkshire, South Yorkshire, Tyne and Wear and West Midlands. Data are collected separately for Wigan metropolitan district and Isles of Scilly local authority district.

Source: Department for Environment, Food and Rural Affairs; Welsh Assembly Government

recycling targets as a means of achieving the national household recycling target of 17 per cent. The rates achieved varied from 2.5 to 46 per cent, with the majority of authorities achieving between 10 and 20 per cent. Fifteen per cent of authorities failed to achieve a rate of at least 10 per cent. Most of the authorities with relatively high recycling rates (20 per cent and above) were located in the South East and East of England, and there are pockets of authorities with low recycling rates (less than 10 per cent) in the North East, North West and London (Map 11.17). No waste disposal authority in England had a household waste recycling rate of less than 5 per cent.

Local authorities in the South East and East of England collected the largest amount of household waste for recycling in 2003/04, both collecting 5.4 kilograms per household per week. Local authorities in London collected the least, at 2.6 kilograms per household per week.

There has been an increase in the amount collected for recycling in each type of authority, with a slightly larger increase of 27 per cent between 2002/03 and 2003/04 in metropolitan authorities compared with London and non-metropolitan authorities. However non-metropolitan authorities still recycle more at 5.0 kilograms per household per week. A regional comparison of the composition of materials collected for recycling showed wide variation across the regions. For example, only 17 per cent of materials collected in London, and 20 per cent in the North East, were for composting, compared with 37 per cent in the North West and 35 per cent in the East Midlands.

Land use

Demand for housing and associated infrastructure constitutes the main pressure for developing land in rural areas and for recycling land already in use in urban areas. In 2000 the Government set a target of 60 per cent of new housing to be built on previously developed land or converted from existing buildings. This target, to be achieved by 2008, aims to minimise the effect of house building on the countryside. In England 70 per cent of new homes (including the conversion of existing buildings, which are estimated to add about 3 percentage points to the national figure) were built on previously developed 'brownfield' land in 2004 (Figure 11.18).

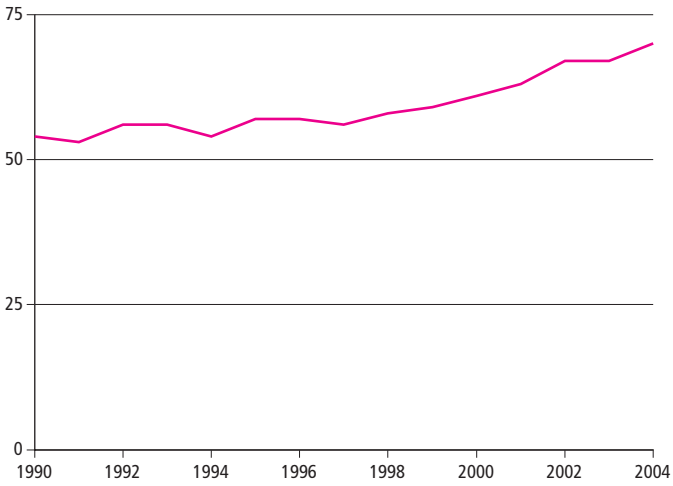
The percentage of new homes built on previously developed land is much higher in urban areas, but there is also considerable regional variation. Over the period 2000–04, London had the

Figure 11.18

New homes built on previously developed land[1]

England

Percentages



1 Includes conversions of existing buildings.

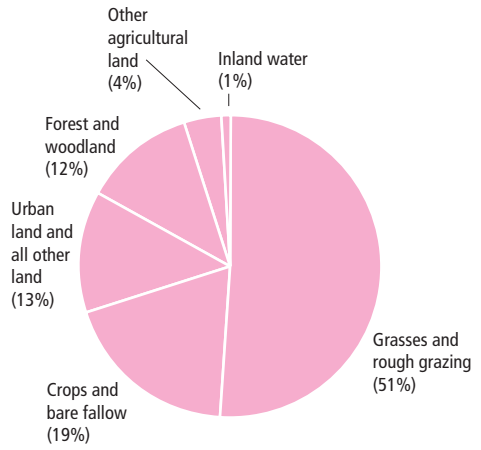
Source: Office of the Deputy Prime Minister

Figure 11.19

Inland area: by land use, 2004

United Kingdom

Percentages



Source: Department for Environment, Food and Rural Affairs

highest rate, generally over 90 per cent (excluding conversions), and the East Midlands and the South West had the lowest rates, both at around 50 per cent (see also Figure 10.4).

While 70 per cent of new homes were built on previously developed land, the proportion of previously developed land used for new housing was lower (58 per cent). This is largely because of the higher density of new dwellings which are mostly in urban areas (on average, 29 dwellings per hectare), and the lower density of building on land not previously developed (23 dwellings per hectare).

Land use is defined as the main activity taking place on an area of land. Over 70 per cent of the total UK land area is under agricultural uses (Figure 11.19), and so much of what many people consider 'natural' landscape is in fact the result of many centuries of human intervention. The total area of agricultural land fell by 1 per cent between 1998 and 2004. The area under crops fell by 8 per cent in the same period, mainly as a result of EC Set Aside Schemes – the amount of set aside land rose by 80 per cent between 1998 and 2004. Rough grazing land decreased by 5 per cent and grassland increased by 3 per cent, while urban and other land use increased by 10 per cent.

Between 1998 and 2004 there was a drop in the area covered by most crop types, in line with a fall in the overall area under crop production. However the area used for growing cereals other than wheat and barley has increased by 18 per cent over this period.

Over the past ten years, concerns about the possible impact that the use of pesticides, BSE in cattle, and the development of genetically modified (GM) crops may have on people's health and the environment have led to an increased interest in organic farming. There has been an increase in the area of land under organic production since 1998. By December 2004, 635,500 hectares of land in the United Kingdom were under organic production, though this still only represented 4 per cent of total area (Figure 11.20). However this increase began to slow in 2002, and the amount of land converting to organic production – a process that takes two to three years – has fallen since 1999.

At December 2004, Scotland had the largest proportion of organically farmed land, at 7 per cent of its total area. Wales had 4 per cent, England 3 per cent, and Northern Ireland less than 1 per cent. Most land that is organically farmed (or is in the process of being converted to organic farming) in the United Kingdom is used for permanent or temporary pasture – 85 per cent in December 2004. In contrast, 67 per cent of all agricultural land in 2004 was grassland or used for rough grazing. Just 9 per cent of organic land was used for growing cereals and other crops in December 2004, and 2 per cent for fruit and vegetables.

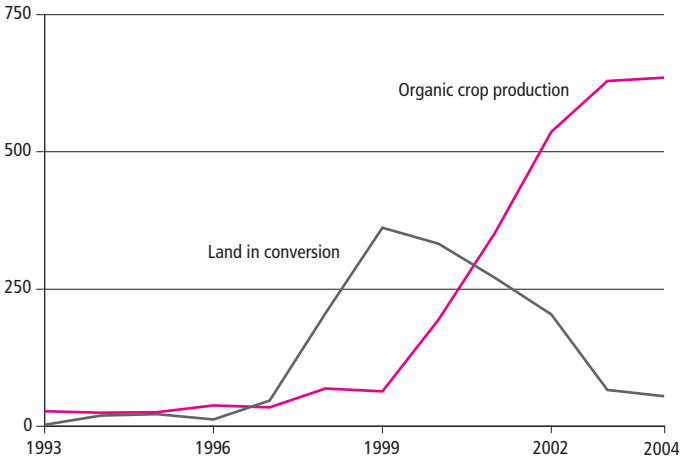
The area of woodland in the United Kingdom fell to a low of around 1.1 million hectares at the beginning of the 20th century but has more than doubled since then, reaching 2.8 million hectares in 2005. This represented approximately 12 per cent of the land area of the United Kingdom. Ancient woodland, which has existed since the earliest reliable records began (over 400 years ago in England and Wales), covered around 2 per cent of the United Kingdom. These often contain complex and fragile ecosystems, and preserve historical features.

Figure 11.20

Land under organic crop production[1]

United Kingdom

Thousand hectares



1 Figures for 1993 to 1999 use dates closest to December. From 2000 onwards, data are at December.

Source: Department for Environment, Food and Rural Affairs

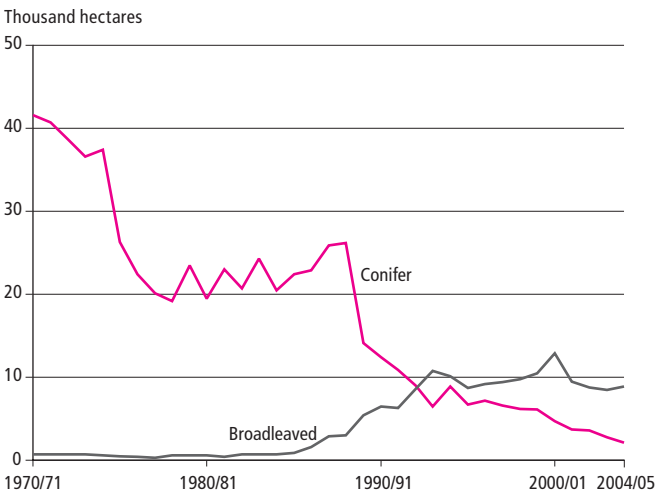
Although there is a greater area of conifer than broadleaved forest and woodland in Great Britain, new broadleaved woodland creation on land not previously used for afforestation has exceeded that of conifers since 1993/94 (Figure 11.21). Between 1990/91 and 2004/05 the area of new land planted each year with conifers fell by 83 per cent, while planting of broadleaved trees rose by 36 per cent. Before the 1990s timber production remained the key priority, resulting in the planting of conifers that were suitable for timber but not usually native to Great Britain. Since then additional incentives for planting broadleaved trees and native pinewood, and for planting on former agricultural land, have led to a growth in the area planted with broadleaved trees, and the continued decline in the planting of new conifers, 8,900 and 2,100 hectares respectively in 2004/05.

Hedges, walls, fences and other boundary features are an integral part of the UK landscape. They provide habitats for many animal and plant species and act as a barrier against soil erosion and loss. They can also act as protective corridors for movement for some species and help maintain biodiversity. There are an estimated 1.8 million kilometres of these features in the United Kingdom. Although the Countryside survey in 1990 revealed a net loss of field boundaries in Great Britain, in particular of hedges, between 1984 and 1990 as a result of agricultural and other types of development, the results of the Countryside survey in 2000 indicate that these declines have been halted.

Figure 11.21

New woodland creation[1]

Great Britain



1 Figures exclude areas of new private woodland created without grant aid. See Appendix, Part 11: New woodland creation.

Source: Forestry Commission

Wildlife

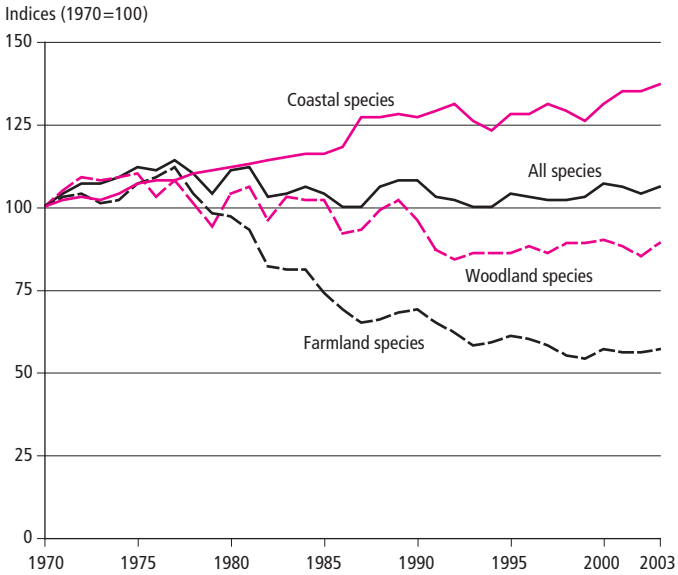
Wild bird populations are considered to be good indicators of the broad state of the environment, as they tend to have a wide range of habitats and tend to be at or near the top of the food chain. The size of the total population of UK breeding birds has been relatively stable over the last two decades. In 2003 the population of 111 native bird species across the United Kingdom was 6 per cent higher than it was in 1970, similar to the level in 2000. However the trends for different species groups vary. The steepest decline has been in the population of farmland species, such as the turtledove, skylark and corn bunting, which almost halved between 1977 and 1993, but has been relatively stable since (Figure 11.22). The woodland bird population fell by around 20 per cent between 1974 and 1998, with the main decrease taking place in the late 1980s and early 1990s. The population of coastal birds has risen steadily and in 2003 was 37 per cent higher than 1970.

Although populations of the more common farmland and woodland birds have been declining, rare bird populations, which are not included in this index, have been stable or rising. This reflects conservation efforts focused on these rare species, and some species possibly benefiting from climate change in southern areas of the country.

Figure 11.22

Population of wild birds[1]

United Kingdom

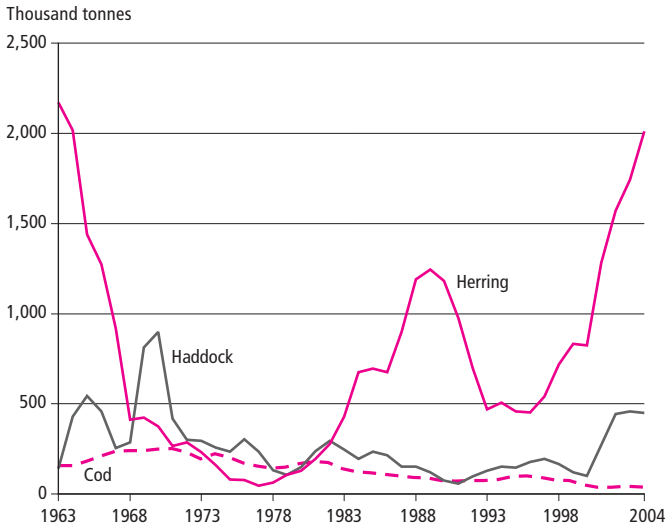


1 It was not possible to complete the Breeding Birds Survey in 2001 because of restrictions imposed during the outbreak of foot-and-mouth disease. Estimates for that year are based on the average for 2000 and 2002 for individual species.

Source: British Trust for Ornithology; Royal Society for the Protection of Birds; Department for Environment, Food and Rural Affairs

Figure 11.23

North Sea fish stocks



Source: Centre for Environment, Fisheries and Agriculture Science, International Council for the Exploration of the Sea, Department for Environment, Food and Rural Affairs

Table 11.24

Threatened species and habitats,[1] 2002

United Kingdom Number

	Species	Habitats
Lost	16	0
Continued or accelerated decline	67	3
Slowed decline	30	14
Fluctuating/no clear trend	40	2
Stable	76	6
Increase	25	6
Unknown[2]	137	14
All	391	45

1 According to the UK Biodiversity Action Plan (BAP) published in 1994.
2 Not yet assessed.

Source: UK Biodiversity Partnership

Fish have traditionally formed an important food resource for many people in the United Kingdom, and they are vital elements of ocean ecosystems. Stocks of herring in the North Sea, after declining to very low levels in the 1970s, have recovered strongly (Figure 11.23). Haddock stocks have fluctuated since the 1960s, and continue to do so; they increased by more than four times between 2000 and 2005.

Stocks of cod in the North Sea and elsewhere are causing particular concern. After increasing in the 1960s, North Sea stocks have declined since the early 1970s, and in 2004 were 73 per cent lower than in 1980. There was, however, a small increase between 2001 and 2004. The depletion in numbers is thought to have occurred through a combination of overfishing, small numbers of fish surviving to a size where they are taken commercially, and possible environmental factors such as changing sea temperatures. Measures have been put in place that aim to halt and ultimately reverse the decline in cod stocks. These have included restrictions on cod fishing during the key spring spawning periods, cuts in the numbers that can be caught, and a limit to the number of days each month fishermen can spend at sea catching cod.

UK priority species and habitats are those that have been identified as being most threatened in response to the UN Convention on Biological Diversity. Biodiversity Action Plans have been put in place to establish the reasons for their decline and the work necessary for recovery. In 2002, of the 254 assessed priority species, 44 per cent were declining or had been lost, 10 per cent were found to be increasing, and 46 per cent were stable, fluctuating or showed no clear pattern since 1994 (Table 11.24). A further 137 species had not yet been assessed.

Of the 31 assessed priority habitats, 55 per cent were declining or lost, 19 per cent were found to be improving, and 26 per cent were stable, fluctuating or showed no clear pattern. A further 14 habitats had not yet been assessed.

Furthermore, the International Union for Conservation of Nature and Natural Resources produces a global 'red list' of plants and animals it considers to be threatened. In 2004 the United Kingdom had 42 species of animal, comprising 10 mammals, 10 birds, 12 fish, 2 molluscs and 8 invertebrate species, and 13 plant species that were considered to be critically endangered, endangered or vulnerable.

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Contact points

For enquiries about this publication, contact the Editor.

Tel: 020 7533 5778
E-mail: social.trends@ons.gsi.gov.uk

For general enquiries, contact the National Statistics Customer Contact Centre.

Tel: 0845 601 3034 (minicom: 01633 812399)
E-mail: info@statistics.gsi.gov.uk
Fax: 01633 652747
Post: Room 1015, Government Buildings,
Cardiff Road, Newport NP10 8XG

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