20

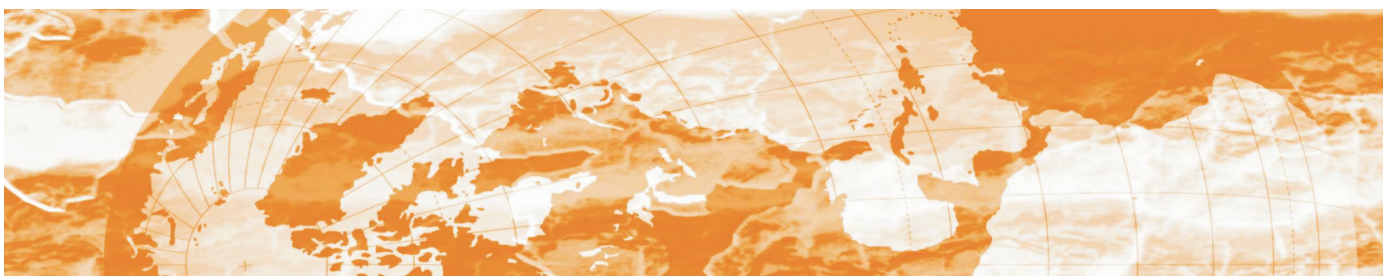
Environment

- The total number of registered vehicles has increased by 118% over the period 1990-2006. Related CO_2 emissions increased by 179% in the same period.

- Ireland's total primary energy requirement in 2006 was 15.9m TOE – an increase of 67% since 1990.

- Greenhouse gas emissions (as measured in Carbon Dioxide (CO_2) equivalents) have increased by 24% during the years 1990 to 2006 while acid rain precursor emissions (as measured in Sulphur Dioxide (SO_2) equivalents) have decreased by 26% in the same period.

- The tonnage of household and commercial waste collected in 2006 increased by 12% relative to 2005. Of the 2006 figure some 36% was recoverable.



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Introduction

This chapter contains data on aspects of the physical environment. Greater coverage is available in the publications of the Environmental Protection Agency (EPA) and Sustainable Energy Ireland (SEI).

Table 20.1 contains information on the land areas afforested, together with the associated levels of carbon sinks (changes in forest and other woody biomass stocks). Forests absorb carbon dioxide from the atmosphere and store it in the biomass until the eventual release as a result of burning or timber decay.

The Transport sector accounts for an increasing proportion of energy consumption and table 20.2 details the growth in vehicle numbers and CO_2 emissions. One example of a pressure indicator derived from economic prosperity and activity is identified in table 20.2, namely the number of cars per 1,000 population. Sources of energy by fuel type and energy consumption over the period 1990-2006, which give an indication of the needs of the Irish economy for energy and how they are sourced, are given in tables 20.3 and 20.4.

The next six tables (tables 20.5-20.10) deal with Greenhouse gases, Acid rain agents, air quality and river quality. Tables 20.11-20.12 contain statistics relating to the generation and recycling of household and commercial waste. Data is provided on various aspects of Ireland's climate in table 20.13 in respect of 2006. The graph with table 20.13 shows that over the past 100 years the mean temperature for Ireland has increased by 1^{o} C and that the 1990s was the warmest decade in the last 120 years.

Technical Notes

Table 20.1

Forest land is defined as all public and private plantation forests. Forest land is an area of land where tree crown cover is greater than 20% of the total area occupied or 50% of conventional stocking and includes recently clearfelled areas. It has a minimum width of 20m and a minimum area of 0.1 hectares and includes all trees with a potential to reach 5m in height. Trees grown for fruit or flowers are excluded, as are woody species such as furze and rhododendron.

According to the Revised 1996 IPCC Guidelines, for the purposes of reporting, the signs for carbon removals are always shown as negative with carbon emissions shown as positive. Net changes in carbon stocks are converted to CO_2 by multiplying by 44/12 (the atomic weight of Carbon is assumed to be 12 and the atomic weight of Oxygen is assumed to be 16) and by changing the sign for net CO_2 removals to be negative.

Table 20.5

Table 20.5 does not contain the actual quantities of HFCs, PFCs and SF_6 gases because these comprise a large number of different types of gases, all of which have their own "CO_2 Equivalent" factor. This means that, unlike the stable relationship between say CH_4 and the CO_2 equivalent, there is no common conversion factor for these gases and the CO_2 equivalent that is published (the conversion factor depends on the mix of gases each year).

Definitions

TOE = Tonnes of Oil Equivalent

HFCs = Hydrofluorocarbons

PFCs = Perfluorocarbons

SF_6 = Sulphur hexafluorides

PM_{10} = Particulate matter measuring less than 10 microns in diameter

$\mu g/m^3$ = Microgram per cubic metre

WEEE = Waste Electronic and Electrical Equipment

Table 20.1 Land areas afforested and CO_2 sinks

	Hectares public	Hectares private	Hectares total	Hectares annual change	CO_2 sinks kilotonnes
1981	298,907	100,774	399,681	6,374	–
1982	304,923	101,272	406,195	6,514	–
1983	310,621	101,599	412,220	6,025	–
1984	315,813	102,072	417,885	5,665	–
1985	320,438	102,689	423,127	5,242	–
1986	325,126	104,969	430,095	6,968	–
1987	330,521	107,923	438,444	8,349	–
1988	337,632	112,519	450,151	11,707	–
1989	344,261	121,016	465,277	15,126	–
1990	350,931	130,163	481,094	15,817	-478.02
1991	358,786	141,455	500,241	19,147	-391.91
1992	366,351	150,589	516,940	16,699	-201.01
1993	373,178	159,760	532,938	15,998	-275.98
1994	379,800	172,597	552,397	19,459	-207.58
1995	386,167	189,940	576,107	23,710	-245.02
1996	390,593	206,495	597,088	20,981	-216.91
1997	391,444	217,078	608,522	11,434	-349.44
1998	394,370	227,080	621,450	12,928	-505.17
1999	395,261	238,857	634,118	12,668	-591.85
2000	396,725	253,088	649,813	15,695	-474.15
2001	397,042	268,235	665,277	15,464	-624.88
2002	397,361	282,970	680,331	15,054	-738.42
2003	397,489	291,939	689,428	9,097	-1,060.00
2004	397,610	301,556	699,166	9,738	-665.77
2005	397,674	311,588	709,262	10,096	-811.38
2006	397,699	319,600	717,299	8,037	-957.61
2007	397,460	300,380	697,840	-19,459	n/a

Source: Forest Service

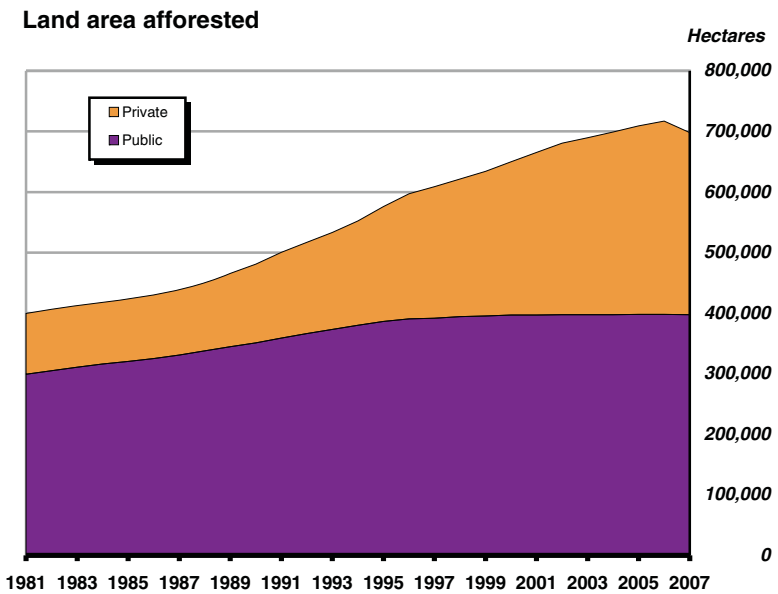

Table 20.2 Road transport

	Number of private cars	Total number of vehicles	Population	Number of private cars per 1,000 of population	CO_2 emissions from road transport kilotonnes	Road Freight Tonne-km (million)
1980	734,371	911,031	3,401,000	216	–	–
1981	774,594	949,819	3,443,400	225	–	–
1982	709,000	882,140	3,480,000	204	–	–
1983	718,555	897,381	3,504,000	205	–	–
1984	711,098	906,109	3,529,000	202	–	–
1985	709,546	914,758	3,540,000	200	–	–
1986	711,087	922,484	3,540,600	201	–	–
1987	736,595	959,753	3,546,500	208	–	–
1988	749,459	981,296	3,530,700	212	–	–
1989	773,396	1,019,560	3,509,500	220	–	–
1990	796,408	1,054,259	3,505,800	227	4,701	–
1991	836,583	1,105,545	3,525,700	237	4,906	–
1992	858,498	1,126,473	3,554,500	242	5,357	–
1993	891,027	1,151,238	3,574,100	249	5,321	–
1994	939,022	1,202,273	3,585,900	262	5,560	–
1995	990,384	1,262,503	3,601,300	275	5,718	5,493
1996	1,057,383	1,338,616	3,626,100	292	6,722	6,316
1997	1,134,429	1,432,330	3,664,300	310	7,082	6,998
1998	1,196,901	1,510,853	3,704,900	323	8,441	8,203
1999	1,269,245	1,608,156	3,744,700	339	9,356	10,275
2000	1,319,250	1,682,221	3,789,500	348	10,107	12,348
2001	1,384,704	1,769,684	3,847,200	360	10,551	12,405
2002	1,447,908	1,850,046	3,917,200	370	10,833	14,448
2003	1,507,106	1,937,429	3,979,900	379	11,004	15,898
2004	1,582,833	2,036,307	4,045,200	391	11,612	17,288
2005	1,662,200	2,138,680	4,133,800	402	12,355	18,152
2006	1,778,861	2,296,393	4,239,800	420	13,093	17,687

Source: Department of the Environment, Heritage and Local Government; CSO and Environmental Protection Agency

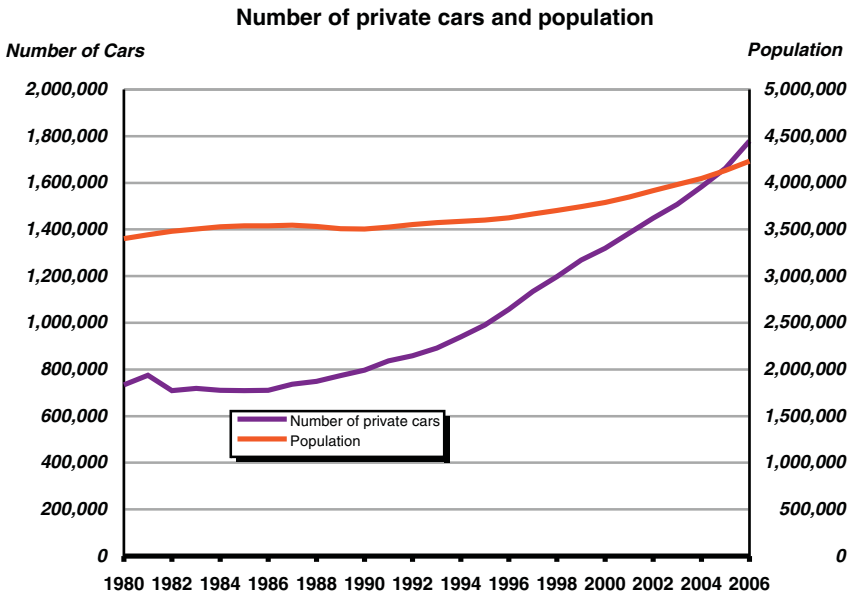

Table 20.3 Total primary energy requirement by fuel type

	Millions of tonnes of oil equivalent (TOE)							Percentages						
	1990	2001	2002	2003	2004	2005	2006	1990	2001	2002	2003	2004	2005	2006
Coal	2.09	1.88	1.75	1.70	1.78	1.83	1.63	21.9	12.9	11.9	11.6	11.7	11.6	10.3
Peat	1.38	0.86	0.89	0.81	0.57	0.78	0.71	14.5	5.9	6.0	5.5	3.8	4.9	4.4
Oil	4.43	8.51	8.50	8.10	8.71	9.15	8.98	46.6	58.3	57.5	55.5	57.6	58.0	56.4
Natural Gas	1.45	3.14	3.33	3.66	3.65	3.48	4.02	15.2	21.5	22.6	25.1	24.1	22.0	25.3
Renewables	0.17	0.23	0.26	0.24	0.28	0.37	0.42	1.8	1.6	1.8	1.6	1.9	2.3	2.7
Electricity imports	0.00	-0.02	0.04	0.10	0.14	0.18	0.15	0.00	-0.2	0.3	0.7	0.9	1.1	1.0
Total	**9.50**	**14.60**	**14.78**	**14.60**	**15.14**	**15.77**	**15.91**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Sustainable Energy Ireland

Table 20.4 Final energy consumption by sector

	Millions of tonnes of oil equivalent (TOE)						Percentages					
	1985	1990	1995	2000	2005	2006	1985	1990	1995	2000	2005	2006
Transport	1.72	2.02	2.39	4.08	5.03	5.39	27.9	27.8	29.8	37.7	39.8	41.4
Residential	2.09	2.26	2.22	2.52	2.95	2.99	33.9	31.1	27.7	23.3	23.4	23.0
Industry	1.68	1.72	1.98	2.54	2.64	2.69	27.2	23.7	24.7	23.5	20.9	20.6
Agriculture	n/a	0.25	0.34	0.32	0.34	0.32	n/a	3.5	4.2	2.9	2.7	2.5
Services	0.68	1.01	1.09	1.37	1.68	1.62	11.0	13.9	13.6	12.6	13.3	12.5
Total	**6.17**	**7.27**	**8.01**	**10.83**	**12.65**	**13.01**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Sustainable Energy Ireland

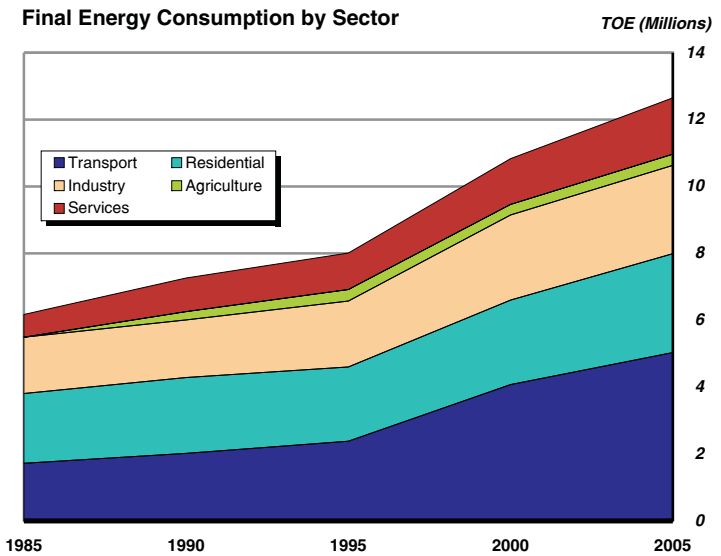

Table 20.5 Greenhouse gas emissions

Kilotonnes

	1990	1999	2000	2001	2002	2003	2004	2005	2006
Carbon Dioxide (CO_2)	32,716.90	42,201.10	44,974.77	47,299.82	45,753.86	44,803.98	45,753.88	47,267.54	46,795.93
Methane (CH_4)	641.36	668.83	644.80	632.92	636.37	664.13	636.14	631.55	632.79
Nitrous Oxide (N_2O)	30.62	34.01	32.50	30.82	29.28	28.75	28.23	28.04	27.31
Total	**33,388.89**	**42,903.94**	**45,652.06**	**47,963.56**	**46,419.51**	**45,496.86**	**46,418.24**	**47,927.13**	**47,456.03**

Source: Environmental Protection Agency

Table 20.6 Greenhouse gas emissions, in CO_2 equivalents

CO_2 equivalent kilotonnes

	1990	1999	2000	2001	2002	2003	2004	2005	2006
Carbon Dioxide (CO_2)	32,716.90	42,201.10	44,974.77	47,299.82	45,753.86	44,803.98	45,753.88	47,267.54	46,795.93
Methane (CH_4)	13,468.57	14,045.37	13,540.74	13,291.26	13,363.76	13,946.65	13,358.95	13,262.47	13,288.57
Nitrous Oxide (N_2O)	9,492.52	10,542.94	10,073.58	9,553.07	9,076.77	8,913.57	8,750.44	8,693.90	8,465.48
HFCs, PFCs and SF_6	36.19	462.08	591.59	616.95	559.23	697.46	635.96	699.35	723.37
Total	**55,714.19**	**67,251.49**	**69,180.68**	**70,761.10**	**68,753.62**	**68,361.66**	**68,499.23**	**69,923.26**	**69,273.35**
Base year 1990=100	100.00	120.71	124.17	127.01	123.40	122.70	122.95	125.50	124.34

Source: Environmental Protection Agency

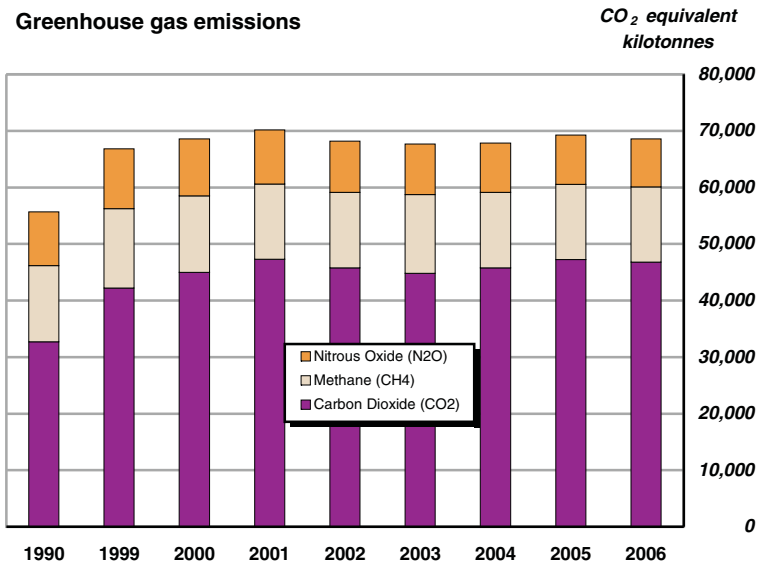

Table 20.7 Acid rain and ozone precursors

Kilotonnes

	1990	1999	2000	2001	2002	2003	2004	2005	2006
Sulphur Dioxide (SO_2)	182.84	157.67	137.16	129.64	99.64	77.94	72.14	70.90	59.89
Nitrogen Oxides (NO_X)	126.56	136.37	139.10	140.66	131.05	126.23	125.73	127.28	122.44
Ammonia (NH_3)	109.61	125.40	121.31	115.41	113.00	111.72	110.57	110.29	109.82
Volatile Organic Compounds (VOC)	108.55	91.43	81.17	78.04	71.18	67.15	63.20	61.76	60.63
Carbon Monoxide (CO)	406.91	274.44	246.71	236.59	218.24	206.46	196.82	187.18	178.39
Total	**934.47**	**785.31**	**725.45**	**700.34**	**633.11**	**589.50**	**568.46**	**557.41**	**531.17**

Source: Environmental Protection Agency

Table 20.8 Acid rain precursors, in SO_2 equivalents

SO_2 equivalent kilotonnes

	1990	1999	2000	2001	2002	2003	2004	2005	2006
Sulphur Dioxide (SO_2)	182.84	157.67	137.16	129.64	99.64	77.94	72.14	70.90	59.89
Nitrogen Oxides (NOX)	88.01	94.83	96.73	97.81	91.13	87.78	87.43	88.51	85.14
Ammonia (NH_3)	206.33	236.05	228.36	217.25	212.71	210.31	208.14	207.60	206.73
Total	**477.18**	**488.55**	**462.25**	**444.70**	**403.48**	**376.03**	**367.71**	**367.01**	**351.76**
Base year 1990=100	100.00	102.38	96.87	93.19	84.56	78.80	77.06	76.91	73.72

Source: Environmental Protection Agency

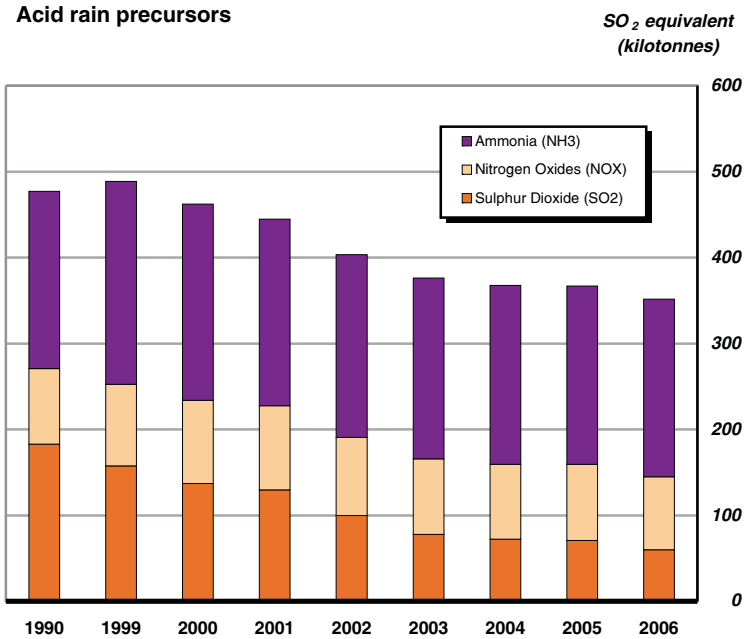

Table 20.9 Air quality – number of days with PM_{10} greater than 50 µg/m^3 in Dublin

Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Wood Quay	74	66	45	-	28	14	28	14	8	10
Rathmines	9	12	3	6	18	12	27	16	7	13
Phoenix Park	5	5	6	4	12	8	9	2	2	2

Source: Environmental Protection Agency

Table 20.10 River quality (based on the national scheme of biological classification)

% of channel length

	1987-1990	1991-1994	1995-1997	1998-2000	2001-2003	2004-2006
Unpolluted	77.3	71.2	67.0	69.8	69.2	71.4
Slightly polluted	12.0	16.8	18.2	17.0	17.9	18.1
Moderately polluted	9.7	11.4	13.8	12.4	12.3	10.0
Seriously polluted	0.9	0.6	0.9	0.8	0.6	0.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Environmental Protection Agency

Table 20.11 Total household and commercial waste collected

Tonnes

	1984	1995	2001	2002	2003	2004	2005	2006
Total household and commercial waste collected	**854,866**	**1,385,439**	**2,297,603**	**2,398,769**	**2,559,387**	**2,703,603**	**2,779,097**	**3,100,310**
Base year 1984=100	100.0	162.1	268.8	280.6	299.4	316.3	325.1	362.7

Source: Environmental Protection Agency

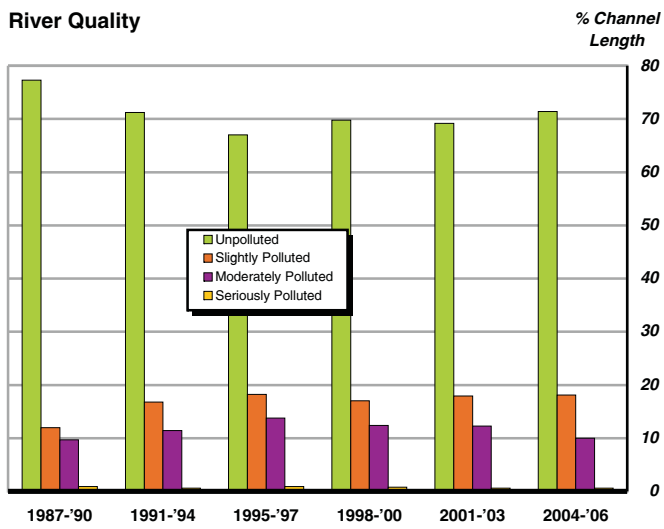

Table 20.12 Disposal and recovery of household and commercial waste and packaging in 2006

Tonnes

	Paper and cardboard	Glass	Plastic	Ferrous, aluminium and other metals	Textiles	Organics	Wood	Others	Total
Total household and commercial wastes collected by type	**1,063,841**	**164,181**	**327,141**	**116,670**	**176,474**	**779,015**	**219,317**	**253,672**	**3,100,310**
Waste quantity landfilled	**475,284**	**59,873**	**263,615**	**62,299**	**166,623**	**723,670**	**15,480**	**213,773**	**1,980,618**
Household waste landfilled	264,815	51,032	190,336	45,515	151,717	499,287	12,413	164,130	1,379,246
Commercial waste landfilled	210,469	8,841	73,279	16,784	14,906	224,383	3,067	49,643	601,372
Waste quantity recovered	**588,556**	**104,308**	**63,526**	**54,370**	**9,851**	**55,345**	**203,837**	**39,899**	**1,119,692**
Household waste recovered	185,956	85,876	32,163	12,019	9,361	39,305	14,469	14,847	393,995
Commercial waste recovered	402,600	18,432	31,363	42,351	490	16,040	189,368	25,052	725,697
Total waste recovered (%)	**55.3**	**63.5**	**19.4**	**46.6**	**5.6**	**7.1**	**92.9**	**15.7**	**36.1**
Packaging waste generation	**398,681**	**154,499**	**263,939**	**66,778**	**211**	**–**	**112,972**	**31,391**	**1,028,472**
Packaging quantity disposed	102,145	58,483	209,203	36,392	211	–	2,437	30,082	438,953
Packaging quantity recovered	296,536	96,016	54,736	30,386	0	–	110,535	1,309	589,519
Total packaging recovered (%)	**74.4**	**62.1**	**20.7**	**45.5**	**0.0**	**–**	**97.8**	**4.2**	**57.3**

Source: Environmental Protection Agency

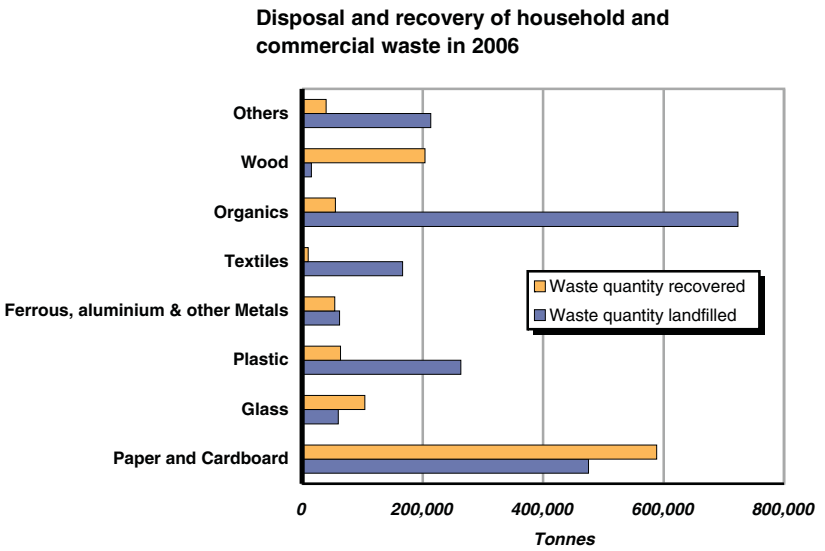

Table 20.13 Climate, 2006

	Belmullet	Birr	Casement aerodrome	Clones	Knock Airport	Cork Airport
Rainfall (mm)						
Total	1,399.2	911.3	676.5	1,054.1	1,205.6	1,198.3
% of average	127	112	93	115	n/a	98
Most in a day (mm)	50.5	26.7	37.6	26.7	39.2	42.2
Date(s)	21-Sep	25-Oct	15-Nov	25-Oct	25-May	25-Oct
Temperature (°C)						
Mean	11.1	10.4	10.6	10.1	9.1	10.4
Diff. from average	+1.5	+1.1	+1.3	+1.3	n/a	+1.0
Highest	29.9	30.1	31.0	28.9	25.9	25.4
Lowest	-4.6	-7.8	-7.5	-6.6	-3.4	-4.0
Sunshine (hours)						
Total	3.96	3.87	4.24	3.75	3.10	4.29
% of average	106	109	111	102	n/a	109
Most in a day amount (hours)	15.0	14.8	15.0	15.2	14.5	15.4
Date(s)	27-Jun	15-Jul	17-Jul	15-Jul	14-May	02-Jun
No. of days with:						
Rain (>0.1 mm)	245	203	177	222	249	202
Snow	8	n/a	5	n/a	9	6
Air frost	11	32	39	32	28	7
Hail	36	n/a	11	n/a	10	5
Thunder	10	n/a	9	n/a	1	4
Fog	16	n/a	15	n/a	123	89
Gale gusts	125	34	82	42	68	80

Source: Met Éireann

Table 20.13 Climate, 2006 - continued

	Dublin Airport	Kilkenny	Malin Head	Mullingar	Rosslare	Shannon Airport	Valentia Observatory
Rainfall (mm)							
Total	740.0	895.2	1,156.9	1,004.5	904.5	968.5	1,760.7
% of average	n/a	108	111	109	102	105	126
Most in a day (mm)	29.7	40.6	34.3	31.8	32.3	47.8	55.3
Date(s)	15-Nov	15-Nov	23-Nov	03-Dec	15-Nov	21-Sep	25-Oct
Temperature (°C)							
Mean	10.3	10.6	10.6	10	11.4	11.1	11.5
Diff. from average	n/a	+1.3	+1.3	+1.2	+1.3	+1.0	+1.1
Highest	26.5	30.2	25.9	29.4	23.3	30.2	26.8
Lowest	-5.8	-6.4	-1.5	-7.2	-2.3	-5.8	-2.8
Sunshine (hours)							
Total	4.51	4.29	3.92	4.12	4.85	4.08	3.89
% of average	112	117	111	114	108	112	109
Most in a day amount (hours)	15.6	15.4	15.8	15.3	15.5	15.3	15.6
Date(s)	02-Jun	02-Jun	25-Jun	01-Jun	02-Jun	06-Jun	02-Jun
No. of days with:							
Rain (>0.1 mm)	192	194	231	226	168	211	240
Snow	8	n/a	8	n/a	3	3	3
Air frost	32	43	6	39	5	23	5
Hail	7	n/a	35	n/a	6	10	17
Thunder	6	n/a	5	n/a	7	15	7
Fog	24	n/a	11	n/a	25	23	8
Gale gusts	75	33	171	16	13	68	76

Source: Met Éireann

Ireland's Annual Temperature deviation from the 1961-90 average (9.65 C) with 15 year smoothed average superimposed. (Average based on data from Valentia, Birr, Malin, Dublin)